DOCUMENT RESUME

ED 252 047 EC 171 304

TITLE Working Papers in Speech-Language Pathology and Audiology. Volume XII.
INSTITUTION City Univ. of New York, Flushing. Queens Coll. Dept. of Communication Arts and Sciences.
PUB DATE Aug 84
NOTE 99p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS Aphasia; *Audiology; Black Dialects; *Communication Disorders; Hearing Aids; Hearing Impairments; *Intervention; Learning Disabilities; Parent Child Relationship; Phonology; *Speech Therapy; Student Evaluation

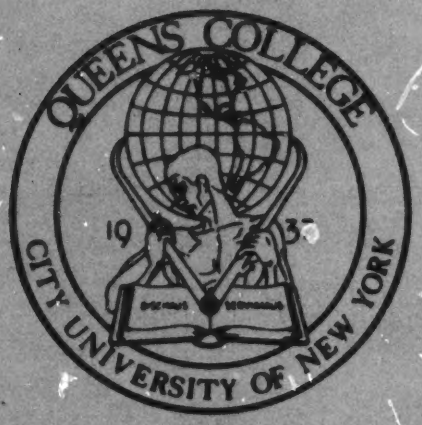
ABSTRACT

Seven papers report on speech language pathology and audiology studies performed by graduate students. The first paper reports on intelligibility of two popular synthetic speech systems used in communication aids for the speech impaired, the Votrax Personal Speech System and the Echo II synthesizer. The second paper reports facilitation of tense discrimination by adding semantic redundancy to written sentences of an aphasic 75-year-old. The third study examined the relationship between Black English dialect and articulation disorders. An assessment of the directional microphone hearing aid in the clinical setting is followed by an investigation of the middle latency response measuring auditory sensitivity in adults with normal and impaired hearing. The sixth paper presents findings of an investigation of mother-child interactions with a language disordered child; qualitative and quantitative differences in the mother and clinician dyads were noted. The final study suggested that the communication problems of learning disabled children may be the result of an interaction involving cognitive, social, and linguistic deficits. An index to the contents of the first 11 volumes of working papers is included. (CL)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED252047

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☑ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.



WORKING PAPERS IN SPEECH-LANGUAGE PATHOLOGY AND AUDIOLOGY

Speech and Hearing Center
Department of Communication Arts and Sciences
Queens College of the City University of New York

EC171304

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Joel Stark
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

VOLUME XII 1984
2

QUEENS COLLEGE

of THE CITY UNIVERSITY OF NEW YORK

FLUSHING • NEW YORK 11367-0904

EPARTMENT OF COMMUNICATION ARTS AND SCIENCES

QUEENS COLLEGE SPEECH AND HEARING CENTER

JOEL STARK, PH.D., DIRECTOR

TELEPHONE: 212-520-7358/7359

August, 1984

This is the twelfth volume of the reports of studies completed by our graduate students with the assistance of the faculty. They were initially implemented as a means of getting our students involved with the clinical process as a research endeavor. We are pleased with the visibility and response these papers have had. Mostly, we are very grateful to our faculty for their inordinate contribution to this project.

Robert Rosenbaum
Joel Stark

BEST COPY AVAILABLE

Contents

Intelligibility in two synthetic speech systems: a pilot study.
Elizabeth Levinson, Arlene Kraat 1

The influence of semantic redundancy on tense discrimination in aphasia.
Karen J. Dikeman, Ilene Bayone 17

An observation of the phonology of black Englis speaking children
Doreen Fisher, Ann Jablon 32

Assessment of the directional microphone hearing aid in the clinical setting.
Robin J. Knapp, James Dempsey 43

Utilization of the middle latency response measuring auditory sensitivity.
Martha Jove-D'Amato, Marvin Mazor 51

Mother-child interactions with a language disordered child.
Maureen Kelly, Renee Hochman Kornet 60

A learning disabled child's ability to request clarification of unclear messages.
Lauren Cwenar, Elaine Geller 73

Contents of the first eleven volumes 89

Intelligibility in two synthetic speech systems: a pilot study

Elizabeth Levinson
Arlene Kraat*

Abstract

This research study addressed the intelligibility of two popular synthetic speech systems used in communication aids for the speech impaired, the Votrax Personal Speech System (PSS) and the Echo II synthesizer. The systems were compared using eight word sentences selected from the Assessment of Intelligibility of Dysarthric Speech (Yorkston and Beukelman, 1981). Sentences were presented in two modes: a full sentence at a normal rate, and a full sentences with 2 1/2 second pauses between composite words. Sixty-four sentences were presented to one adult listener. Sentences were randomly assigned to one of four conditions: Votrax with no additional pauses; Votrax with pauses; Echo with no additional pauses; Echo with pauses; and presented through an Apple II computer in a free field condition in a sound proof room. Intelligibility scores were determined by calculating the number of words correctly identified for each stimulus sentence. These scores were compared between synthesizers and for the effect of pause on the intelligibility within a system and across systems. Results indicated differences in intelligibility for the two synthesizers for this subject, and the positive impact of pause time. particularly for the Echo II synthesizer. These differences did not reach statistical significance, however clinical implications are discussed.

Speech is the most natural means of conveying information among individuals. However, recent figures indicate that more than one million children, adolescents and adults are unable to communicate effectively through this mode (ASHA, 1981). In the past, this severely impaired population was often viewed as untreatable, or placed in speech treatment programs with limited improvement expected. However, within the last few years, advances have been made in the area of non-speech communication or what is more commonly known as augmentative communication. It is now possible to provide individuals whose speech is permanently or temporarily impaired, with an alternate system to meet their communicative needs. These alternative means may take the form of signs or facial expressions, gestures, communication boards, charts or electrical aids.

These augmentative communication systems are used for communication in two primary ways (Yoder and Kraat, 1983). One group of individuals is using an augmentative system as a backup system for those instances when verbal communication is not understood; i.e., a dysarthric speaker may communicate through this system only when his speech is unintelligible to a particular listener. Another group of individuals may be so severely impaired that an

*Faculty Supervisor

augmentative aid must serve as their primary means of communication.

Several types of aided augmentative systems are currently available for children and adults with severe speech impairments. These include a variety of non-electronic boards and displays, and several commercially available electronic and computerized communication devices (Vanderheiden, 1978; Kraat and Sitver, 1983). These devices use a variety of input techniques through which the user can interact with the communication device; multiple symbol and orthographic displays and capacities; and several output modes through which the aid user can communicate with others. Output modes may include a visual display or paper printer through which written communication is transmitted, synthetic speech, taped speech, and modes in which the vocabulary items are temporarily indicated through pointing or scan techniques and must be noted by a communication partner who is present.

Since 1978, there has been a rapid increase in the number of voice output communication aids (VOCA's) commercially available to the non-vocal individual. A few of these aids were developed for the handicapped market, (e.g., the HandiVoice 110 and 120), and others were designed for use by the general public or business community, (e.g., Texas Instrument's Speak 'n Spell, Votrax Type 'n Talk used with the personal computer). The majority of VOCA's use speech synthesis as their output mode. Speech synthesis (artifically produced speech) is the primary form of speech output used because it does not limit the user to a prestored number of words as does taped speech, and cost and memory requirements are not limiting factors (Vanderheiden, 1976).

A variety of synthetic speech systems are commercially available for use in communication devices as internal chips or external peripherals (e.g., Echo, Votrax, IntexTalker, Sweetalker). These speech synthesizers vary greatly in quality and in how speech output is achieved. Synthetic speech may be based on linear predictive coding methods of synthesis, which utilizes digital filtering techniques, or based on formant synthesis, a technique which attempts to model the resonances introduced into speech by the shape of the vocal tract (Damper, 1982).

Some communication aids have stored words or letters that the user has available to him (e.g., Vocaid, Speak 'n Spell). Others require the individual to create words by combining units at the phoneme or allophone level (e.g., HandiVoice 110) or use text-to-speech rules to generate words and sentences. Text-to-speech systems still use phonemes and allophones as a base, but the user no longer has to learn how speech is represented phonetically nor how to program in the phonemes and allophones. Instead an additional set of rules or algorithms are written which convert conventional orthography into allophone strings (Goodrich, 1979).

Presently, there are several text-to-speech and synthetic systems available under development (Nye, Hankins, Rand, Mattingly, and Cooper, 1973; Kurtzweil, 1976; Elovitz, Johnson, McHugh, and Shore, 1976; Hertz, 1981; Allen, 1981; Klatt, 1982; May, 1982; and Clark, 1983). These synthetic speech systems are being incorporated into numerous technical aids for the disabled under development in the laboratories (Carlson, Galyas, Granstrom, Hunnicutt, Larsson, and Neovius, 1981; Goodenough-Trepagnier, Goldenberg, and Fried-Oken, 1981; LeBlanc , 1981; Demasco and Foulds, 1982; and Baker, 1982), newly available devices (e.g., Express 3, Words +, Omni, ScanWriter) and personal computers.

It is evident that the direction today is toward the development and use of speech synthesis, however, little research has been conducted in terms of how intelligible or effective these systems are in communication. In the past, professionals have commented that they sound "mechanical" and "dysarthric" (Vanderheiden, 1976). However, very few researchers have investigated whether one particular speech synthesizer is more intelligible than another. This area needs to be researched in order to determine how synthesized speech compares to natural speech in intelligibility, and to determine which system(s) are most intelligible.

Pisoni and Hunnicutt (1980) evaluated the intelligibility and comprehension of synthesized speech produced by the unrestricted text-to-speech system in research development, MITalk. In the first part of their study, seventy-two undergraduate students listened to monosyllabic words taken from the Modified Rhyme Test (MRT), a closed response set. Results showed that the level of performance of synthetic speech was lower than that obtained using natural speech, a difference of 6.3%, however, both types of speech were extremely high. Overall performance on the synthetic speech showed only 6.9% errors.

When these researchers presented different monosyllabic words in an open response test format to two different groups of listeners, the level of performance decreased for both types of speech. However, the error rate was much greater using synthesized speech as the stimuli. Natural speech received an error rate of 2.8% (an increase of 2.2% when compared to scores received in the closed response set), as compared to a 24.6% error rate using synthetic speech (a 17.7% increase when compared to scores received in the closed response test). Word recognition performance using synthetic speech in two lists of sentences; the Harvard Psychoacoustic list developed by Egan (1948), all of which are meaningful, and a list of syntactically normal but semantically anomalous sentences developed by Nye and Gaitenby (1974) called the Haskins sentence list, also produced a substantial difference. Twenty-one adults listened to the Harvard list produced by the MITalk synthesizer and an overall mean of 93.2% correct word recognition score was noted. Twenty-three adults listened to the meaningless sentences produced by this system and received an overall mean of 78.7% correct word recognition score. When the stimulus was produced using natural speech, the scores on the Harvard and Haskins sentence list were 99.2% and 97.7% respectively.

Results of the two word recognition tasks demonstrated that the level of word recognition performance depended a great deal on the type of test used (open or closed response formats). More demands are placed on the listener when they must identify words in nonsense sentences. When the listener is not provided with contextual information, as in the nonsense sentences, intelligibility scores in the synthetic speech sentences were lowered (93.2% using meaningful sentences as compared with 78.7% in nonsense sentences).

This research study using the MITalk indicates the potential intelligibility that can be achieved in synthetic speech systems. However, it should be noted that this particular system is in research and development, and has the most advanced synthesis rules and output means available. Results of testing done with the MITalk should be viewed as the ultimate in speech intelligibility and not confused with the capabilities of other systems on the market with fewer rules, less memory, and lower cost. In its present form, the MITalk is expected to be costly, and has memory demands that require a non-portable computer and wall current.

The nonspeaking population needs communication devices that are highly portable and affordable. In regard to speech synthesis, this generally means that they need a speech output system that has moderate memory demands, can be powered from rechargable batteries, and is realistic in terms of cost. Consequently, many of the speech synthesizers used in commercially available products for the disabled are low cost synthesizers that appear to have reduced intelligibility (Bell, 1983). These low-cost synthesizers have received little research attention.

Initial tests of intelligibility of the more popular, low cost synthesizers reveal significantly reduced scores of intelligibility. Quality of these speech synthesizers is usually poor. In a study by Williams, Simpson and Nordinger (1981), the Versatile Portable Speech Prosthesis (VPSP), a new device under development, was compared for intelligibility with the HandiVoice, a commercial unit using a Votrax synthesis chip. The test materials included sentences from Campbell (1965), a CNC list of phonemically balanced monosyllabic words developed by Peterson and Lehiste (1959), and one closed response word list from the Modified Rhyme Test (MRT) by Fairbanks (1958) and by House, Hecker and Kryter (1965). Subjects were college age students who had no prior experience listening to synthesized or digitized speech. Ten individuals heard VPSP speech and another ten heard the HandiVoice speech. Intelligibility was defined as the percentage of words correct out of the total number of words presented. Results using all three groups of materials indicated that the VPSP was significantly more intelligible than the HandiVoice. In the CNC word intelligibility task, the VPSP received an intelligibility score of 44%, whereas the HandiVoice's intelligibility score was only 10%. In comparison, the MITalk system (a text-to-speech system) received an intelligibility score of 75.4% in a similar task (Pisoni and Hunnicutt, 1980). In the Modified Rhyme Word Intelligibility task, the VPSP intelligibility score was 63% as compared to 43% in the HandiVoice. Sentence intelligibility for the VPSP was 71% compared to 26% for the HandiVoice. This difference was statistically significant ($t=12.39$, $df=18$, $p<0.001$ (2-tailed)). Although this study demonstrates that significant differences exist between these two systems in terms of intelligibility, it is also apparent that both synthesizers are far inferior to the intelligibility of speech. Of the two systems, the commercially available synthesizer (HandiVoice) was most severely reduced in intelligibility.

In another study of a commercially available low cost synthesizer (Pisoni, 1983), word recognition tasks using the Votrax Type 'n Talk resulted in an intelligibility score of 67%. This system is currently used by nonspeaking individuals and on testing demonstrates reduced intelligibility compared to higher cost systems like MITalk. This further highlights the need for additional research regarding the intelligibility of speech in commercially available communication devices.

These three reported studies on the intelligibility of synthesized speech are not sufficient to give us a picture of the use of synthetic speech aids. Only two commercially available systems, the HandiVoice and the Votrax Type 'n Talk have been investigated. In both studies, intelligibility was severely reduced for these systems on the tasks given, although the degree of deterioration differed. This is in sharp contrast to results reported for the MITalk, which reflect mildly reduced intelligibility scores.

As synthetic speech aids continue to be designed and available for the

nonspeaker, and as their use continues to increase, it is important to take a closer look at the systems available in terms of speech intelligibility. It is important to compare the intelligibility of various speech synthesizers and text-to-speech systems available for the nonspeaker to determine those that are optimal for communication partners and use. In addition, it is important to examine these systems in relation to the mode of presentation used: Some devices present spoken speech a word at a time (e.g., Vocaid), while others give the user the option of presenting a word, phrase, or a sentence to the listener at one time (e.g., Express 3, Words Plus).

Little is known about the effect of presentation mode on the intelligibility of synthesized speech. Slowiaczek and Nusbaum (1983) have suggested that a reduced rate of presentation may increase the intelligibility of synthetic speech. There is also evidence in the research work of Yorkston and Beukelman (1978) that pause time between words facilitates understanding of significantly distorted or dysarthric speech. In their study of dysarthric speech, these researchers found an interaction between severity and intelligibility scores on sentences and words in a transcription task. The least intelligible speakers received higher intelligibility scores on single words than on sentence level tasks; the reverse was true for those with mild intelligibility problems. This work suggests that, in addition to the synthesizer itself, word versus sentence presentation modes may have an impact on intelligibility.

This study focuses on the intelligibility of two popular synthetic speech systems, the Votrax Personal Speech System (PSS), (1982) a product of Votrax, 500 Stephenson Highway, Troy MI, 48084, and the Echo II synthesizer (1982). a product of Street Electronics Corp., 1140 Mark Ave., Carpinteria, CA, 93103. These synthesizers are used as internal speech chips within communication devices (e.g., Express 3, Scanwriter) and as external peripherals to aids and personal computers for the speech handicapped. These systems use text- to-speech rules and synthesis forms that differ from each other. Both systems are capable of varied mode presentations at the word, phrase, and sentence level, the decision being the user's.

Specifically, this study addressed the following questions:

(1) Is there a significant difference in intelligibility between the Echo II and the Votrax Personal Speech System in a sentence intelligibility task? and,

(2) Does pause addition between words significantly alter intelligibility within one of the systems or across both systems?

Method

Subject

The subject of the pilot study was a twenty-four year old woman who was a college graduate employed as a tax auditor. She was a native English speaker with no previous experience or training with synthesized speech. Pure tone tests indicated normal hearing of at least 20db HTL or better through the frequency range 250-4000 Hertz, bilaterally.

Apparatus

All stimuli were presented to the subject in a sound treated room at the Queens College Speech and Hearing Center in a free-field condition with the subject seated two feet from the external speaker. The synthesized sentences in both systems were presented through a Radio Shack Realistic external speaker, which is purchased as part of the Echo II synthesizer product. Stimuli were presented through the same speaker to reduce any speaker effects on the test results or system intelligibility. The synthesized sentences were presented directly from the Apple II+ computer and synthesizers.

Sixty-four sentences were selected from the eight (8) word sentence intelligibility task section of the Assessment of Intelligibility of Dysarthric Speech (Yorkston and Beukelman, 1981). This test of intelligibility was selected for the study because it contains sentence material based on sentence length (five to fifteen words/sentence) and this variable could therefore be controlled. The test also contains words chosen from the 30,000 most frequently occurring words (Thorndike and Lorge, 1944). Other sentence intelligibility tests considered were the CID Everyday Sentence Test (Davis and Silverman, 1978), the Spin Test (Kalikow, Stevens and Elliot, 1977), and the Harvard Psychoacoustic Test (Egan, 1948) These tests were rejected as length was not controlled, and/or the content was judged as not providing an adequate representation of everyday speech. An eight word sentence length was selected as it occurs with frequency in conversation and was judged to be long enough to reflect differences between the systems without overtaxing the listener's short term memory capabilities (personal communication, Beukelman, 1983).

Sentences assigned to each synthesizer and pause/no pause condition were generated and stored on a computer disc using an Apple II + computer, a specialized software program, and the synthesizers under study. For this study, the Echo II synthesizer used was based on the Texas Instrument 5200 speech chip, and the Votrax PSS was based on the Votrax SC - 01A chip.

As these speech synthesizers use a text-to-speech conversion, sentences were generated using traditional orthography from the computer keyboard. However, spelling was changed to minimize the effects of various text-to-speech rules under the following conditions: (1) the traditional spelling adds or omits a syllable; and (2) the traditional spelling alters the vowel to the point of substituting another vowel, as opposed to a distortion. (See Appendix for sentences and spelling alterations used.)

Procedure

The Yorkston and Beukelman eight-word sentence test contains one hundred (100) sentences. Sixty-four (64) of these sentences were randomly selected for

the experimental task. Each of the sixty-four (64) sentences was randomly assigned to each of the following categories:

Synthesizer	Condition
Echo II	1. Full sentence 2. Sentence with a 2 1/2 sec. pause between words.
Votrax	1. Full sentence 2. Sentence with a 2 1/2 sec. pause between words

A randomization list of the four conditions was created. Sentences from each condition were assigned to this randomized order and became the experimental presentation list of 64 sentences.

The pause condition consisted of a 2 1/2 second pause placed between each word in the sentence. No data is available on the amount of pause time recommended between composite words for processing distorted speech, so informal piloting was conducted. Sentences with 1, 1 1/2, 2, 2 1/2, and 3 second pauses were presented to a listener. Based on accuracy of response and attitudes toward the various pause lengths, a 2 1/2 second pause was selected for initial study. The full sentence condition had a normal pause placed between words produced by the space bar on the input keyboard.

All sixty-sour (64) sentences were presented in one experimental session with a five minute break after half of the sentences were given. The subject was instructed to write down the sentence or any portion of the sentence understood at the end of the sentence presentation. Guessing was encouraged. The listener was allowed to verbally repeat the utterance during the presentation. No repetition of any sentence was presented.

Prior to each synthetic sentence presentation, a sentence test number was heard, ex. "sentence number 1" and the sentence was then presented. A 20 second pause was placed between sentence presentations. This time length was reached through informal piloting, and was judged to be sufficient for responding to the task. The subject was questioned at the close of the testing to explore her attitudes toward the presentation modes and two synthesizers under study.

Results

The data from this experiment is summarized in Tables 1 and 2. Table 1 displays the distribution of intelligibility scores in the Votrax Personal Speech System (PSS) and the Echo II synthesizer in pause and no pause conditions. There was a total of sixteen sentences in each synthesizer/condition. Table 2 shows the sum of the raw scores (ΣX) for the sixteen sentences, mean number of words ($\bar{X}$) correct, and the standard deviations in each of the four synthesizer/conditions. Raw scores were determined by the number of words correctly identified out of an eight word sentence.

The intelligibility scores achieved in order of best performance to worst is as follows:

(1) Echo II in pause condition
(2) Votrax PSS in a pause condition
(3) Votrax PSS in a no pause condition, and
(4) Echo II in a no pause condition.

Table 1

Distribution of sentence intelligibility scores in the Votrax Personal Speech System (PSS) and the Echo II synthesizer in pause and no pause condition.

	Number of words correct per sentence over sixteen sentences in each condition								
Synthesizer/ Condition	8	7	6	5	4	3	2	1	0
Votrax PSS-Pause	8	2	3			2	1		
Echo II-Pause	9	3	1		2	1			
Votrax PSS-No Pause	5	4	1	1	2	1	1		1
Echo II-No Pause	2	5		1	3	1		2	2

Table 2

Sum of raw scores for sixteen sentences (X), mean number of words correct (X), and standard deviations (S.D.) for the Echo II synthesizer and the Votrax PSS in pause and no pause condition.

Synthesizer/Condition	X	X	S.D.
Votrax PSS-Pause	104	6.50	2.065
Echo II-Pause	110	6.87	1.707
Votrax PSS-No Pause	92	5.75	2.489
Echo II-No Pause	73	4.56	2.874

To determine whether or not either one of the variables (synthesizer or condition) had an effect on the number of words correct, an analysis of variance was performed. Computing variability between means (effect) and between sentences (error) and using an F-test, it was concluded that there was a significant overall effect. A t-test was used to determine eactly where this effect lies. Three independent tests were conducted, computing a t value for each. One test was to determine whether or not there was a difference between synthesizers overall, including pause and no pause conditions. The second test was to determine whether or not the effect of pause made a significant difference between systems. The third test was to determine whether or not there was an interaction between systems and conditions; in other words, did the pause/no pause condition have a greater effect in one of the systems over the other, and if so, was the difference significant. Results showed that these differences were not significant at any level.

Although the differences were no significant, intelligibility scores differed considerably between synthesizers. The Echo II synthesizer stimulus (no pause condition) received a score of 73/128 or 57% of the words correct within the sentence material; the Votrax stimulus (no pause condition) received a score of 92/128 or 72%. Pause had a positive impact on intelligibility in both the Votrax and Echo synthesizers. The Votrax system with pauses raised the intelligibility score from 72% to 81%; the Echo system with pauses raised the intelligibility score from 57% to 86%.

Discussion

The results of the present study indicate that pauses between words increase overall intelligibility, particularly for the Echo II synthesizer, although not at the level of significance. This tendency regarding the effect of pauses was present in both synthesizers under investigation. This effect of pause time on intelligibility corroborate Yorkston and Beukelman's (1978) findings with severely dysarthric speakers, and Slowiaczek and Nusbaum (1983) suggestion that pauses within sentences appear to increase intelligibility of synthetic speech by allowing listener's more time to process the material. The more distorted the message, the greater is the effect of pauses. In the pilot study, the worst condition (Echo without pause) was effected to the greatest degree by pause addition.

Obviously this study needs to be repeated with a larger N before definitive statements can be made about the effects of pause, or the differences in intelligibility between the Votrax Personal Speech System and the Echo II synthesizers. However, it is important to pursue further study from a clinical perspective. If commercially available synthesizers do differ in the intelligibility of the speech produced, embedding the most intelligibile speech into a communication device would enhance communicative exchange between a non-speaker and his/her partner. In addition, if pauses of a particular length are helpful to the listener in processing this artifical speech, then this could be incorportated into the training procedures, given that the user often has a choice of producing a full sentence at a time, a word at a time, or phrase segment. With rapid advances in technology, it is also not difficult to imagine computers and electronic communication devices with automatic pause time additions between words or phrases, or pause bars of various lengths which could be used by the augmentative aid user to increase his or her overall intelligibility if it is found to be assistive.

Before further research is conducted on a larger N, certain methodological issues should be addressed from the pilot study. It was noted that there was a wide range of variability within conditions regarding the number of words that were correctly perceived (Table 1). In some conditions, sentences ranged from completely unintelligible (a score of 0) to completely intelligbible (a score of 8). It is unclear whether these differences are the effect of sentence variability or differences that result from synthesizers and conditions. To determine whether or not the sentences themselves clouded the results, it may be appropriate to present the same sentences to the pilot subject, but in different conditions (e.g., a sentence presented in the Echo II pause condition would be presented in the Votrax no pause condiion). If the hierarchy of sentence intelligibilty remains the same in this altered presentation, it suggests that differences may be attributed to differences that exist between systems and not between stimulus sentences.

The scoring system used in the pilot study might also have contributed to the lack of significant effects between conditions. It may be of value to attempt to devise a multi-dimensional scoring system or qualitative scale so that finer differences between the systems and conditions can emerge. In the present scoring system, an error which is one phoneme off from the target word (e.g., do/to) and a response which is acoustically unrelated (e.g., made/quick) are both tabulated as word errors. However, these reflect differing degrees of distortion. The synthesizers and conditions under study may show significant differences in intelligibility given other than an all or nothing scoring system. It was noted from this pilot study that severely distorted messages are often filled in by the receiver given the sentential material and some identifiable words. This subject often quessed to make the message semantically and syntactically relevant. This makes qualitative scoring difficult.

The results of this pilot study warrant further research on a larger N. A larger study may produce significant results between conditions that only demonstrated differences in this single subject study (e.g., Echo Pause/Echo No Pause Conditions). A larger N would also be of interest in regard to whether or not individual differences exist in the intelligibility of these two synthesizers and pause/no pause conditions among listeners.

This study has also raised several other questions that need investigation. These include further study of the relationship of sentence length and pause time on the intelligibility of synthetic speech. This research study examined intelligibility given 8 word sentences and a 2 1/2 second pause time between words. It may be that significant intelligibility differences would have been identified with a different sentence length or pause time. It may also be the case that pauses placed at phrase boundries may be equally beneficial or further improve intelligibilty over pauses after words within a sentence. Study of the ability of listeners to acclimate to synthetic speech is also of interest. It may be that the specific synthesizer used and pause times make a difference when conversing with persons who are not familiar with such a communication mode, or a specific population. It remains undefined as to whether or not these differences in intelligibilty remain when given repeated exposure to sythesized speech. In this pilot study, listener performance did not show improvement over the presentation time.

Continued research is needed on the intelligibility of the synthetic speech systems that are commercially available to the non-speaking population. These systems are of reduced quality given the language, memory, portability

and cost demands. Research information is needed in order to make clinical decisions regarding the specific type of synthetic speech that is most appropriate to incorporate into communication devices to enhance communcative exchange between a non-speaker and his/her partners, as well as use strategies that will optimize this new technology.

References

Ad Hoc Committee on Communication Processes and Nonspeaking Persons, Position Statement. Asha , 23 , 577-581, 1981.

Allen,J. Linguistic-based algorithms offer practical text-to-speech systems, In Speech Technology , 1 , 12-16, 1981.

Baker,B. Minispeak. Byte Magazine , 7 , 186-203, 1982.

Bell, T.E. Talk to me. Personal Computing , September, 1983.

Beukelman, D.R. Personal communication, 1983.

Campbell, R. Discrimination test word difficulty. Journal of Speech and Hearing Research , 8 , 13-22, 1965.

Carlson,R., Galyas,K., Granstrom,B., Hunnicut,S., Larson,B., and Neovius,L. A Multi-language, Portable text-to-speech system for the disabled. Proceedings of the Fourth Annual Conference on Rehabilitative Engineering, Washington, D.C., 1981.

Clark,J.E. Intelligibility comparisons for two synthetic and one natural speech source. Journal of Phonetics , 11 , 37-49, 1983.

Damper,R.I. Speech technology implications for biomedical engineering. Journal of Medical Engineering and Technology , 6 , 135-140, August, 1982.

Davis, H., and Silverman, S.R. Hearing and Deafness . New York: Holt, Rinehart and Winston, 1978.

Demasco,P. and Foulds,R. A new horizon for non-vocal communication devices. Byte Magazine , 7 , 166-185, 1982.

Egan,J.P. Articulation testing methods. Laryngoscope , 58 , 955-991, 1948.

Elovitz,H., Johnson,R., McHugh,A., and Shore,J. Letter-to-sound rules for automatic translation of English text to Phonetics. IEEE Trans. ASSP-24 , 446-458, 1976.

Fairbanks,G. Test of phonemic differentiation: The Rhyme Test. J. Acoust. Soc. of Amer. , 30 , 596-600, 1958.

Foulds,R.A. Communication rates for nonspeech expression as a function of manual tasks and linguistic constraints. Proceedings of International Conference on Rehabilitation Engineering, Toronto, Canada, June 1980.

Goodenough-Trepagnier,C., Goldenberg,E.P., and Fried-Oken,M. Nonvocal communication system with unlimited vocabulary using Apple and SPEEC-Syllables. Proceedings of the Fourth Annual Conference on Rehabilitative Engineering, Wash., D.C., 1981.

Goodrich,E. Modern voice generation techniques. Communication Outlook , 2 , 6, 1979.

Hertz,S. SRS text-to-phoneme rules: A three-level rule strategy, ICASSP-81 , 102-105, 1981.

House,A.S., Williams,C.E., Hecker,M.H.L., and Kryter,K.D. Articulation testing methods: Consonantal differentiation with a closed-response set. J. Acoust. Soc.of Amer. , 37 , 158-166, 1965.

Kalikow,D.N., Stevens,K.N., and Elliot,L.L. Development of a test of speech intelligibility in noise using sentence materials with controlled word predictability. J. of Acoust.Soc. of Amer. , 61 , 1337-1351, 1977.

Klatt,D. Review of the science and technology of speech synthesis, In Overviews of Engineering Research Techniques in Hearing, Bioacoustics and Biomechanics , National Academy Press, Wash., D.C., 1982.

Kraat, A. Output modes available in communication devices, Prentke Romich Workshop, Cleveland, 1982.

Kraat, A. Training augmentative communication use: Clinical and research issues from Conference Proceedings, Committee for the Severely Handicapped, Sweden, 1982.

Kraat, A. and Sitver, M. Features of Commercially Available Communication Aids Prentke Romich, Feb., 1983.

Kurtzweil, R. The Kurtzweil reading machine: A technical overview, In Science, Technology and the Handicapped , M.R. Redden and W. Schwandt (Eds.), American Association for the Advancement of Science Report No. 76-R-11, 3-11, 1976.

LeBlanc, M. et al. Research and Development of a Versatile Portable Speech Prosthesis , Final Report. Palo Alto, Calif., Children's Hospital at Stanford, 1981.

May, J.G. Speech synthesis using allophones. Speech Technology , 58-62, 1982.

Montgomery, J. Non-Oral Communication ., Fountain Valley, CA: Plavan School, 1978.

Nye, P.W. and Gaitenby, J. The intelligibility of synthetic monosyllable words in short, syntactically normal sentences. Haskins Laboratories Status Report on Speech Research , SR-37/38, 169-190, 1974.

Nye, P., Hankins,J., Rand,R., Mattingly,I., and Cooper,F. A plan for the field evaluation of an Automated Reading System for the Blind. IEEE Trans. on Audio and Electroacoustics AU-21 , 265-268, 1973.

Peterson, G.E., and Lehiste, I. Revised CNC lists for auditory tests. Journal of Speech and Hearing Disorders , 27 , 62-70, 1962.

Pisoni, D.B., and Hunnicut, S. Perceptual evaluation of MITalk: The MIT unrestricted text-to-speech system. 1980 IEEE International Conference Record on Acoustics, Speech and Signal Processing , 572-575, April 1980.

Slowiaczek, L.M.and Nusbaum, H.C. Intelligibility of Fluent Synthetic Sentences: Effects of Speech Rate, Pitch Contour and Meaning. Paper presented at Acoustical Society of America, May, 1983.

Thorndike, E.L. and Lorge, I. The Teacher's Word Book of 30,000 Words . New York: Teacher's College, Columbia University, 1944.

Vanderheiden, G.C. Synthesized speech as a communication mode for non-vocal severely handicapped individuals. (Unpublished paper avialable from Trace Research and Development Center, University of Wisconsin-Madison, 1976).

Vanderheiden, G.C. (Ed.), Non-Vocal Communication Resource Book , Baltimore: University Park Press, 1978.

Williams, M., Say the word and you'll be free. Communication Outlook , 2, 11, 1980.

Williams, D.H., Simpson, C.A., and Nordinger, C. Comparative intelligibility of VPSP text-to-phoneme speech and Handivoice pre-stored and phoneme speech. Research Report, Rehabilitation Engineering Center, California, 1981.

Yoder, D., and Kraat, A. Intervention issues in non-speech communication, in J. Miller, D. Yoder, and R.L. Schiefelbusch (Eds.), Contemporary Issues in Language Intervention , ASHA Report #12, 1983.

Yorkston, K.M., and Beukelman, D.R. A comparison of techniques for measuring intelligibility of dysarthric speech. Journal of Communication Disorders , 11 , 499-512, 1978.

Yorkston, K., and Beukelman, D. Assessment of Intelligibility of Dysarthric Speech . Seattle: C.C. Publications Inc., 1981.

Appendix

I. Votrax Personal Speech System (re-adjusted spelling parenthesized)

A. Full sentence condition:

1. There are two methods for soaking dried beans.
2. You can wade in the cool slow river.
3. Can you paint a room or portrait (portrit)?
4. You can easily make discoveries (discovereez) on your own.
5. It can be frozen up to two months.
6. Night after night they received annoying phone calls.
7. I looked up and noticed two old men.
8. Many of the best places are privately owned.
9. Enjoy the fair weather while in the tropics.
10. Put them in a coat or jacket pocket.
11. This will not be challenged (challindged) in the court.
12. The boxer threw a quick punch at him.
13. Travel is about the (thee) only leisure we have.
14. For importers and dealers the profits are enormous.
15. The full moon rose (roze) between two eastern peaks.
16. I told her I only had nine minutes (minits).

B. Sentence with 2 1/2 second pause:

1. He's (heez) a young bear and he's (heez) moving on.
2. The veteran coach was concerned about the opponent.
3. Both ways have their advantages (advantadge-iz) and proper uses.
4. We the jury find the defendant not guilty.
5. This year brings a change in the routine (rooteen).
6. Those people are much quicker than I am.
7. I had to throw away all my vests.
8. From politics the emphasis (em-phi-sis) shifted to economic affairs.
9. The airplane came in for a swift landing.
10. Remember the year we lived at the cove (coe-hv)?
11. The process works in other ways as well.
12. You have to expect a few bad calls.
13. Salt is the (thee) only special ingredient you need.
14. Well religion made me what I am today.
15. Well you have to trust in your organization.
16. It was followed by another session at night.

II. Echo II

A. Full sentence condition:

1. This is a period of transition for me.
2. Natural poisons have always existed in our foods (foohdss).
3. If you are losing (loosing) water replace (rei-place) it immediately (imeediutly).
4. A low price will sell a house quickly.

5. Theres no admission charge but donations (doe-nations) are accepted.
6. A friend (frend) of mine has a good truck.
7. Their output was mostly in the second half (haf).
8. Evidence soon accumulated (uhccumulated) that this unusual approach (uhpproach) worked.
9. Cuttings can be planted for flowers (flahwers) next fall.
10. There is little hope that overfishing will cease.
11. The defendant (defendent) is either guilty or not guilty.
12. I soon found myself muttering to the walls (wallss).
13. They say bears (bairz) do strange things to people.
14. It can lead to any number of adventures.
15. Needing more income he took a weekend job.
16. I can train any dog in five minutes (min-its).

B. Sentence with a 2 1/2 second pause:

1. He was a policeman (puhleesman) in a local club.
2. Being close (clowse) to people is important to me.
3. She doesn't like to have it hanging around.
4. I don't (doant) know how to deal with it.
5. The joy of living (lih-ving) is a powerful (power-ful) force.
6. I was pleased (pleezed) with the way things went.
7. I'm delighted to do favors (fay-vers) for my friends (frens).
8. Take some time out to enjoy the season.
9. The lovable (love-iibul) man is not a mamas boy (ma-ma-sboy).
10. For casual (cashual) walking you need no special equipment (eequipment).
11. No one target shoots as well as he.
12. Find out everything (evrythiing) you might need to know.
13. You can describe (dihscr-ibe) mu financial situation as fluid.
14. Dreaming it I moaned suddenly in my sleep.
15. There was only one decision to be made.
16. The wait for work can be very long.

The influence of semantic redundancy on tense discrimination in aphasia

Karen J. Dikeman
Ilene Bayone*

Abstract

Recent studies with aphasic subjects have shown that comprehension of sentences and paragraphs, both in the auditory and written modalities, can be facilitated by changing certain aspects of experimental material. This study attempted to improve an aphasic individual's ability to make tense distinctions (between present, past and future tense) by adding semantic redundancy to written sentences. Redundancies were defined as temporal adverbials, and reinforced the tense aspect of sentences. Despite a significant reading impairment, tense discrimination was facilitated for this subject. Results were discussed in relation to aphasic and reading literature.

The language comprehension of aphasic individuals has been studied with regard to the phonologic, syntactic, semantic, and pragmatic features of language. Various researchers have manipulated these features of language to reveal the nature of the language impairment of their subjects, as well as to discover how their language comprehension can be facilitated (Gardner, Albert, and Weintraub, 1975; Gardner and Zurif, 1976; Stachiowak, Huber, Poeck, and Kerschensteiner, 1977; Pierce, 1981, 1982). Explanations of the results of these studies have varied depending on the particular language model theorized. Generally, results indicate that it is possible to enhance both auditory and reading language comprehension with the addition of redundancies and context to written and spoken material.

Gardner, Albert and Weintraub (1975) reported some of the different language parameters which have been explored regarding auditory language comprehension in aphasia: syntactic components, semantic confusions, temporal sequencing, and connotative meaning. They then examined the influence of some additional factors. One of these was the inclusion of a word in a sentence which either reinforced or was inconsistent with the usual meaning of a target word in the sentence. They defined this addition as either semantically redundant or counter-redundant. For example, when the target word was "cat",the redundant word was "furry". The counter-redundant addition was "sour". Their results indicated that aphasic subjects with anterior and posterior lesions performed better on a semantically redundant sentence than on either a semantically counter-redundant or neutral sentence (where no meaning was added). However, anterior aphasic patients received a higher total score on the task, possibly reflecting their better overall language comprehension.

Gardner, Albert and Weintraub (1975) concluded that comprehension of a word involves more than just understanding the word and its referent. Words in other parts of the sentence contribute to comprehension. They proposed that addition of semantic redundancy to spoken material has clinical implications. The context in which words are spoken must be considered with respect to an aphasic client's comprehension.

---

*Faculty Supervisor

Gardner and Zurif (1976) studied the reading of words and phrases by anterior and posterior aphasics. They theorized that posterior aphasics, who tend to have difficulties with substantive words in a sentence, would derive less benefit from the addition of such stimuli to a sentence. Anterior aphasics, typically able to "read for meaning" without extreme difficulty with substantive words, would perform better on the redundant condition. Subjects were also divided by comprehension level, as assessed by formal testing. The 36 subjects matched the phrase to one of four pictures, one of which was appropriate to the stimulus. Results indicated that subjects were able to derive benefit from the addition of a redundant substantive word to the written phrase. For example, the phrase "new black shoes laying on the soft blue rug." Counter to Gardner and Zurif's hypothesis, site of lesion did not have a significant effect on the results, although severity of comprehension impairment was a highly significant variable. The more impaired subjects did not obtain as much benefit from the added substantive word.

Stachowiak, Huber, Poeck, and Kerschensteiner (1977), found that aphasics' auditory comprehension of a paragraph was less impaired than that of isolated sentences. They theorized that the redundant situational and verbal information in a text compensated for the difficulties in phonologic, syntactic, and semantic processing. Stachowiak et al. did not mention details with regard to the type of redundancies, referring instead to the power of contextual cues in facilitating comprehension (1977). Wilcox, Davis, and Leonard (1978) assessed the ability of aphasic subjects to use extralinguistic cues, or context, in natural communicative settings. Aphasics benefitted from the cues in communicative settings, showing increased comprehension of utterances, more so than on formal tests.

In a series of articles, Pierce (1979, 1981, 1982a, 1982b) assessed the ability of aphasic listeners to comprehend syntax. Pierce (1979) examined the decoding strategies used by aphasic listeners (both fluent and nonfluent aphasics) on various morpho-syntactic distinctions. Subjects pointed to photographs to indicate their interpretation of the stimulus sentence. Pierce concluded that aphasic individuals, lacking situational cues, decode a sentence without attending to syntactic information, such as word order, and morphology, such as an "-ed" ending, used by normal listeners. Aphasic listeners were restricted in terms of their ability to decode syntax and morphology (pierce, 1979).

Based upon these findings, Pierce attempted to improve the comprehension of syntax by aphasic listeners (1981, 1982). The 1981 study was primarily concerned with the facilitation of various tense discriminations. Subjects were 20 aphasics who had had left hemisphere cerebro-vascular accidents. A comprehension level, high or low, was established for each subject based on control condition. Subjects listened to 12 sentences each in the irregular past tense, regular past tense, and future tense. Six sentences contained what Pierce called "additional surface structure markers." For example, an irregular past tense sentence was, "the dog ate his food." With the additional marker, it became "the dog has eaten his food." Pierce (1981) found that comprehension of the marked sentences, as assessed by picture indication, was significantly improved for low and high comprehension groups (regardless of site of lesion).

In his further evaluation of syntactic comprehension in aphasia, Pierce (1982) assessed the same three tense distinctions as in the 1981 study, plus

some word order distinctions. He used the same methods as in prior studies, and again concluded that additional surface structure markers facilitated the ability of aphasic listeners to make tense and word order distinctions. In discussing how these markers facilitated tense discriminations, Pierce (1982) pointed out that the markers placed syntactic restrictions upon the listener, that is, they limited the choices available to the listener in interpretation. He gave the example, "the man has already caught the ball" where the word already (the added marker) is used by the aphasic listener to make an effective judgement on tense. The redundancy already provides a more effective strategy than relying on syntactic information alone. Pierce (1982) considered the redundancy to provide the aphasic listener with powerful alternative decoding strategies in the comprehension of syntax.

Pierce (1982b) did essentially the same study on tense discrimination by aphasic subjects in the written modality. His findings were similar. The redundancies facilitated tense discrimination of written sentences, for all aphasic subjects.

The studies cited examined the effects of certain aspects of syntax, semantics, and context on the auditory and reading comprehension of aphasic subjects. The relevant variables were not clear in all of the studies. Gardner et al. (1975) and Gardner and Zurif (1976) looked at semantic redundancy; in the Goodglass et al. study the relevant dimensions were syntactic, the structural aspect of the sentence. Stachowiak et al. (1977) discussed the power of contextual cues in paragraph comprehension, as did Wilcox et al. (1978). Pierce (1981, 1982, 1982b) spoke of syntactic redundancy but did not make purely syntactic changes in his stimuli. Various language dimensions have been manipulated to facilitate language comprehension.

Most of the above studies done on aphasic language comprehension have focused on the auditory modality, possibly since this has been an area of prime concern for aphasic patients. Certain features of language, e.g., paralinguistic dimensions of stress or rate, can also be monitored in auditory studies. Further, the response mode is generally simpler with auditory comprehension studies. Formal analysis of reading comprehension has not been as extensive as that of auditory comprehension.

Other studies that have investigated reading comprehension in aphasia (Marshall and Newcombe, 1973, Kertesz, 1979, Calvanio and Levine, 1982, Webb and Love, 1983) have involved the classification of aphasic reading syndromes, relationship of the reading impairment to site of lesion, and the discussion of these syndromes in light of normal and impaired language models.

Marshall and Newcombe (1973) analyzed the errors of brain injured subjects during oral reading. Their model of the reading processes proposed that errors occurred at different levels of linguistic processing. The major syndromes of reading impairment or dyslexia that emerged were: (1) Surface dyslexia, where there is a disruption of grapheme to phoneme conversion rules. (2) Direct dyslexia, where reading takes place by association between visual and oral word representations. (3) Deep dyslexia, a syntactic or semantic dyslexia.

Kertesz (1979) investigated the varieties of "aphasic alexia" in a population of 225 aphasics and found that most aphasic subjects are alexic. The variety of alexia was fairly consistent across aphasic groups. Wernicke's aphasics showed sentence, global, and to a lesser extent, verbal alexia.

Kertesz (1979) discussed the link between impaired reading and linguistic processes. Calvanio and Levine (1982) stated that the nature of aphasic alexia did not appear to vary systematically with the location of the lesion. Without theorizing that differences do not exist between alexic patients, they proposed that errors in reading can be examined along a continuum of severity. Visual errors would constitute a mild reading impairment. Semantic errors indicate more serious difficulties. Webb and Love (1983) investigated the reading disorders in what they termed "chronic aphasia," aphasia persisting beyond one year post onset. Each of their 35 subjects, assessed on 12 reading tests of recognition, comprehension, and oral reading, had reading deficits of varying severity. The authors noted that patients who completed word and sentence tasks without error showed delays and comprehension problems when reading text.

Marshall and Newcombe (1973), in their discussion of the adult dyslexic model, proposed a similarity between visual errors in adult acquired dyslexia and child developmental dyslexia. Perfetti (1981) presented a model of reading disability in children that was based on the following premises: (1) Language comprehension (of which reading is a part) involves interactive processes, with information from high order, conceptual knowledge used with lower order, print or speech knowledge. (2) Some of these processes may be limited, and any means of increasing the efficiency of these processes may increase overall success for a limited system. (3) Compensation of less effective processes is possible. Specifically, poor verbal coding skills may be facilitated by using alternate contextual information.

Perfetti (1980) gave his subjects "degraded" visual stimuli to simulate impaired reading processes (degraded stimuli consisted of words printed in an incomplete manner by a dot matrix printer). Perfetti found that as stimulus information is lessened, context becomes more important. "Less able" readers were especially affected by degraded visual stimuli and highly dependent upon context. Perfetti stated that they were able to use their word knowledge and knowledge of sentence constraints to compensate for word identification and decoding deficits. Less able readers were also affected by "reverse" context, which was inconsistent with sentence meanings. His results appear similar to those of studies involving adult aphasics with language impairment (Gardner, Albert and Weintraub, 1975; Gardner and Zurif, 1976; Stachowiak, 1977; Pierce, 1981, 1982a,1982b). Context facilitated auditory and written language comprehension for aphasic subjects and children.

The purpose of this study was to examine the effect of context, defined as semantic redundancy, on the reading comprehension of an aphasic adult. Specifically, the ability to discriminate between three tenses in the written modality, with and without additional semantic "markers", was examined.

Method

Subject

The subject was a 75 year old male who developed aphasia after a CVA (hematoma) to the left temporal lobe in September, 1979. Initial evaluation (September, 1981) indicated that the subject's language characteristics corresponded to a fluent (Wernicke's) aphasia, with fluent speech marked by lack of informational content and numerous paraphasias. Auditory comprehension was severely impaired; on the subtests of the Boston Diagnostic Aphasia Examination (Goodglass and Kaplan, 1972) he scored from -1 to -2 SD below the mean.

Reading was assessed on the BDAE (9/81). The subject scored at or above the mean on subtests of symbol discrimination, word recognition, and word-picture matching. He scored between -1 and -2 SD on sentence reading. On the Reading Comprehension Battery For Aphasia (Lapointe and Horner, 1979) in December, 1982, the subject was good to excellent with symbol and word recognition, and matching single words to pictures. He was moderately inpaired on the sentence level, and severely impaired on paragraph reading. He performed poorly on subtests of functional reading, identification of synonyms, and morpho-syntactic discrimination. Clinical observation indicated that the subject tended to orally and silently read material in the present tense, despite the presence of morphological inflections.

The subject, an avid reader premorbidly, had approximately ten years of formal education, but had continued studying on his own until his stroke. He often described his lack of comprehension for written material. His comments regarding reading corresponded with the findings of Webb and Love (1983), who described aphasic postmorbid reading as neither enjoyable nor as efficient as premorbidly. He wore corrective lenses for distance use and reading. There was no evidence of a field cut; the subject did not display any neglect. Visual acuity was adequate for small (newspaper size) print.

Apparatus

All experimental sessions were conducted in a 9' x 12' therapy room in the Queens College Speech and Hearing Clinic. The experimenter and the subject sat side by side at a small table. Data were collected by the examiner.

Twenty-seven 3" x 2" black and white line drawings, taken from the Test for Auditory Comprehension of Language (Carrow, 1973) were used in the training task. One sentence was used with a group of three pictures, so that one picture was the target response, while the other two were foils. In each training sentence a particular target element (subject, verb, or object) was varied. The target element indicated which of the three pictures was the correct match for the sentence (See Appendix A for a list of training materials).

Twenty-seven black and white line drawings drawn by a college age art student were used for the experimental tense discrimination task. Pictures were drawn on plain 5" x 8" Bristol board with a technical pen. Nine action verbs were depicted, in three tenses each--present, past, and future. For example, for the verb "write" there were three graphic representations--a girl writing a letter, a girl holding up a completed letter, and a girl preparing to write a letter. For consistency, a young girl was shown carrying out the action for every verb and tense.

Fifty-four experimental sentences were used. Each was constructed from simple noun and verb phrase combinations. The nine action verbs were used in six sentences each--present, past aand future in the unmarked or non-redundant condition, and present, past, and future in the marked or redundant condition. For example the unmarked present tense version of the verb "write" was, "the girl writes a letter." The marked version was, "Right now the girl writes a letter" (See Appendix B for a list of materials).

The verbs chosen for the experimental task were dynamic, based on the work of Lahey and Feier (1982), who studied the language dissolution of an adult subject and found that dynamic verbs were the last to be eliminated from a sample of her written productions. They discussed these results in terms of child language development, in which dynamic verbs are the first to appear in language productions. In addition, verbs selected were those that were used with a variety of inflections in children developing morphology. Bloom, Lifter, and Hafitz (1980) found that certain classes of verbs were used primarily with one type of inflection, e.g., only with "ing", when they first emerged. The action verbs in this study were used with more than one inflection. This particular control appeared warrwnted in view of the findings of Lahey and Feier (1982) on similarities between child language development and adult language dissolution. The semantic redundancy or "markers" added to sentences were defined as temporal adverbials by Lund and Duchan, 1980 (Appendix B).

All lexical items (with the exception of one noun) in the training and experimental tasks were taken from AA word frequency levels (Thorndike and Lorge, 1944). Eight of the experimental verbs were AA frequency level, with one from A frequency content words. Sentences were printed on plain 8" x 4" strips of paper, using an Atari 800 computer and Epson printer. The "boldface" printing format was used for all training and experimental sentences, as the subject had expressed a preference for this print versus regular type.

Procedure

Training and experimental materials were presented over six hour long sessions. The training task was constructed to insure that the subject understood the experimental task of reading a sentence and selecting one picture from an array of three. Webb and Love (1983) noted that aphasic subjects, when performing a sentence recognition task, displayed poor strategy in reading sentences and looking for target words. The training task was designed to eliminate any similar difficulty for this subject.

Before the presentation of the experimental items each day, three training items were presented. The three pictures were arranged in a triangular pattern, one above, two below, in front of the subject. The training sentence was then placed in front of him, with the instructions, "Read the sentence and point to the correct answer. Read slowly and look at every word." Correct selection depended on the subject's use of the critical element for that sentence. The critical element was varied (either subject, verb or object) but never involved tense. For example, one training sentence was, "The girl is standing." One picture depicted this action. The two foil pictures were a boy standing and a bear standing; thus the subject was the critical element.

The daily training sentences were varied, so that the subject, verb and object were all presented as critical elements. In this way, the target word in training sentences was always in a different place.

The position of the target picture was rotated clockwise for each presentation. After the subject made his selection, he was given feedback such as, "That's a good answer", "fine", or "nice job." The pictures and sentence were then removed. There was a 15-30 second latency period between presentations while the examiner arranged her materials.

Each day the subject had to demonstrate an ability to read the three sentences and make two out of three correct picture selections. In this way it was assured that the experimental task was reviewed and understood, and the subject was prepared to perform the task.

The experimental items were presented immediately foloowing the training items. Eighteen sentences were presented each day, for six days, until each sentence in the pool of 56 had been presented twice. Nine unmarked, without the redundancy, and nine marked with the redundancy, were used each day. The particular 18 sentences to be presented in a session were pre-selected in order to control the verb tenses and conditions given. The unmarked and marked versions of the same tense were not presented on the same day, i.e., the subject did not see the sentences, "The girl writes the letter," and "Right now the girl writes the letter" on the same day. Within the pool of 18, the sentences were presented randomly.

The format for presentation of the experimental pictures and sentences was exactly the same as for the training items. The three pictures were arranged in front of the subject, with the position of the target picture rotated in a clockwise position for each presentation. For each presentation, one tense pictured was the correct response. The other tenses became the foil items. The position of the foil items was also changed for each presentation, to insure that no tense was in the same position over a number of trials.

The subject's responses were checked against the list of sentences given on that day, so that the verb, tense, and condition (unmarked or marked) were clear to the examiner. The examiner recorded the tense and the position of the picture chosen. Any remarks made by the subject in explanation of his choices were also noted.

Results

The raw scores and means for the correct responses, marked and unmarked conditions, are shown in Table 1. The subject correctly identified more marked than unmarked sentences. To determine if the difference between the two conditions, marked and unmarked, was significant, the test for determining significance of the difference between correlated means was performed (Ferguson, 1971). The data did not reach significance at the .05 level.

The subject scored higher on the marked versions of the present and future tense sentences, although differences between marked and unmarked sentences were not significant. The subject correctly identified 14 marked present tense sentences, as opposed to 11 unmarked sentences. In the future tense, six marked sentences were correctly identified, versus three unmarked sentences.

Table 1

Correct responses, marked and unmarked conditions.

Day	Marked	Unmarked
1	4	4
2	5	2
3	3	2
4	1	2
5	4	3
6	4	3
Totals	21 X=3.5	16 X=2.7

For the past tense sentences, the subject did not score higher on the marked versions of the stimuli. He was correct with two unmarked sentences, as opposed to one marked sentence. To investigate any effect of a particular verb on the subject's performance, his choices for each verb and tense were examined. No verb in itself appeared to create any special difficulty for this subject. The subject's errors were analyzed for any patterns. Out of 71 incorrect responses, 53 were selections of the present tense foil. Thirteen were of the future tense foil and five of the past tense foil.

Discussion

The results of this study appear in agreement with the trend in the aphasia literature regarding the value of context or redundancy in facilitating language comprehension. However, conclusive results were not obtained, as the data failed to reach significant levels.

A qualitative analysis of the data yielded parallels with other studies involving the use of redundant information. Gardner, Albert and Weintraub (1975), Gardner and Zurif (1976), Von Stockert and Bader (1976), Stachowiak et al. (1977), Wilcox et al. (1978), Goodglass et al. (1979) and Pierce (1981, 1982a,1982b) all concluded that context or redundancy of different types facilitated aphasic language comprehension. Studies in reading, by Gardner and Zurif (1976) and Pierce (1982b) indicated that comprehension could be facilitated specifically in the written modality.

The above researchers discussed their results in terms of site of lesion of their subjects, classified as either posterior/anterior, fluent/nonfluent, or Wernicke's/Broca's aphasics. In each study, site of lesion did not appear to be a significant variable in the ability of the aphasics to use various redundancy. However, the severity of the subject's comprehension impairment was cited as a significant variable in these contextual studies (Gardner, Albert and Weintraub, 1975; Gardner and Zurif, 1976; Stachowiak et al., 1977; Goodglass et al., 1979; Pierce, 1981). The more impaired the subjects were, the less benefit they were able to derive from the added redundancy.

Severity of the comprehension deficit has also been cited as a significant determiner of type of aphasic reading impairment. Marshall and Newcombe (1973), Kertesz (1979), Calvanio and Levine (1982) and Webb and Love (1983) investigated the varieties of aphasic alexia. More so than any clear link with lesion location, the aphasic reading impairment appeared to follow a "severity continuum," as discussed by Calvanio and Levine (1982). For example, Marshall and Newcombe (1973) proposed major syndromes of reading impairment--surface, direct, and deep dyslexia--where severity and error type varied. Similarly, Kertesz (1979) separated aphasic alexia into literal, verbal, sentence, global and diffuse alexia. Kertesz wrote that aphasic alexia could be generally classified along aphasic groups (i.e., many Wernicke's aphasics demonstrated sentence alexia). However, he stated that error types in each dyslexic group were multiple and not completely separated. Webb and Love (1983) concluded that reading impairment was highly correlated with the overall language impairment and the auditory comprehension deficit of subjects. They discussed the variability of impairment along tasks of recognition, oral reading, and comprehension.

The studies cited indicate that the overall severity of aphasic language impairment affects the ability of a subject to use redundant information, as well as influencing type and degree of reading impairment present. The subject of this study was classified as a fluent or Wernicke's aphasic with a language comprehension deficit placing him in the moderately-severely impaired range of aphasia. This classification was accomplished through clinical observation, testing on the BDAE (Goodglass and Kaplan, (1972) and, specifically for reading processes, on the RCBA (LaPointe and Horner, 1979). (Gardner, Albert and Weintraub (1975) and Gardner and Zurif (1976) also used the BDAE in classifying their subjects as to the severity of impairment). The subject's performance on the experimental task, reading in the redundant and nonredundant conditions, appears in agreement with the literature cited. This subject was able to derive benefit from added semantic redundancy, which increased has ability to perform an experimental task. However, the data in this study were not significant. This may be accounted for by the very severity of the subject's impairment, which, as for other highly impaired subjects, (Gardner, Albert and Weintraub, 1975; Gardner and Zurif, 1976; Pierce, 1981) prevented him from deriving maximum benefit from the redundancy.

The classification of this subject by type of reading impairment appears to place him within several of the syndromes proposed, near the most impaired range of the "severity continuum". In the classification system of Marshall and Newcombe (1973), this subject seems of the "deep dyslexic" type. Deep dyslexia, involving syntactic/semantic errors, would always occur in the presence of other aphasic impairments. In Kertesz's classification, the subject seemed to best fit into sentence alexia, the breakdown in reading occurring beyond the single word level. As with Webb and Love's (1983) study, this subject was most impaired in areas of comprehension of material, less so in recognition and matching tasks. With this degree of alexic impairment, The subject's skill in using written redundancy was possibly limited. The additional word could not always provide the needed information to aid in the tense discrimination task, due to the overall severity of the reading impairment. As Gardner and Zurif (1976) proposed, the reading "strategy" in severe aphasia may be that semantic information is used less. This subject may have been too impaired to make full, effective use of the written semantic redundancy.

The RCBA (1979) was given to this subject in order to assess his reading impairment. As a newer assessment tool, it has not been widely used and quoted in the literature. Van Demark, Lemmer, and Drake (1982) discussed the use of the RCBA as an assessment tool, and concluded that it has high levels of test stability, internal consistency, and validity. They also investigated a correlation of reading impairment as measured on the RCBA with the overall severity of aphasia and with the auditory language deficit, and discovered a significant correlation.

Van Demark et al. (1982) reported two other results relevant to this study. First, the order of difficulty of the RCBA subtests was not significantly different for fluent versus nonfluent aphasic subjects (the fluent aphasic group, it should be noted, was smaller than the nonfluent group). These findings appear to confirm the theory of a reading severity continuum for aphasic subjects, less so than a one to one correlation of deficit and lesion site. Second, all aphasic subjects in this study performed poorest on the subtest of "morphosyntactic" reading. This subtest involves several items similar to the experimental task of tense discrimination. The subject of this study also experienced difficulty with this subtest, scoring only 30% correct. In view of the difficulty of the experimental task, as well as the subject's reading impairment, it is possible that the semantic redundancy was not "powerful" enough to help him in tense discriminations. Unable to effectively use morphology in the tense discrimination task, and lacking the maximum benefit of the redundancies, performance was not significantly facilitated.

Responses to the tense discrimination task were compared to those of Pierce's subjects (1981, 1982a, 1982b). Pierce (1981) theorized that part of the value of redundancy or "markers" in his study was to allow subjects to recognize that a sentence was in a tense other than the present. The redundant information in this study was designed to provide "support" for the target tense. The additional word provided necessary information, in order to make a tense judgement. The redundancy in this study appeared to provide this support in some cases. In studying one sentence, the only marked past tense verb correctly identified, the subject remarked to himself, "Well, she already went into the house." He then selected the correct picture. In this case, he appeared to demonstrate that he recognized the past tense verb "went" partly by using the marker already . As verbalized in his explanation, he seemed to use the marker in his reading strategy.

The way that subjects use the redundant information is not known, but various theories have been presented. Perfetti (1981), in his work with children, proposed that dyslexic readers were impaired in the "bottom-up" reading process, involving decoding stimuli, or actual word processing skills. These "less able readers" as he called them, were able to use context, when it fit their knowledge of the world, to read material. They were affected when that context was manipulated, just as the aphasic subjects in the study by Gardner, Alber and Weintraub (1975) were affected by counter-redundant

information. Pierce (1981) suggested that aphasics may use redundant information in a "top-down" process, where the context was used to cue tense information. Some parallels between children and aphasic subjects who are inpaired in reading ability (possibly in the bottom-up process) may exist. For example, both may rely on a "top-down" reading process, requiring contextual support. A continuum of impairment in children also existed, so that some children were less able to utilize context (Perfetti, 1981), just as severely impaired aphasics receive decreased benefit from redundancy.

A result of this study different from Pierce's (1981, 1982a, 1982b) results was the subject's difficulty with the past tense. Pierce reported that his subjects had the greatest difficulty comprehending future tense sentences. This subject's problems were with past tense sentences. Except for the example cited previously, and two other selections, he did not seem to be able to decode the past tense. For example, again verbalizing to himself in explanation, the subject repeated the verb "jumped" as "jumps", repeating "jumps, jumps" and pushing away the past tense picture. This subject was more successful with the future tense sentences. Pierce's (1981) results may have resulted from the use of "is going to" as a redundancy for the future tense. His aphasic subjects amy not have been able to use "is going to" as one unit due to the length of the phrase, and so may have missed the supportive meaning.

The selection of the present tense foil for a significant number of error responses was in agreement with the findings of Pierce (1981, 1982a,1982b). The subject of this study, as the subjects in Pierce's work, seemed most likely to select the present tense picture. He appeared confident in his selections of the present tense, despite the presence of any inflections.

Pierce (1981) commented that verb aspect might have influenced his subjects, in their selection of past and future sentences. In the present study, the effect of verb aspect was controlled. Based on the findings of Lahey and Feier (1982), who found correlations between an adult's language dissolution and child language development, the verbs chosen for this study were those that emerged with a variety of inflections in children's language. As these verbs tended to occur with several different inflections in the language of children learning morphology, the influence of verb type on choice of tense was hpoefully avoided. Results appeared to confirm this control. It was noted that the verb "go" in child language os an "all purpose, pro-verb" which could take a variety of inflections (Bloom, Lifter, and Hafitz, 1980). Lahey and Feier (1982) found that "go" was used correctly, inflected for past tense, more so than any other verb, in the writings of their aphasic subject. In the present study, the verb "go" was the only correct marked past tense verb, was correctly selected in all three tenses, and was correctly selected six times, the highest number of correct responses for any verb. A conclusive result can not be made on the basis of this one verb, but the subject's ability to use this particular verb seems to suggest a further parallel with adult language dissolution and child language, and a need for more research in these areas.

This study attempted to answer some questions regarding the usefulness of semantic redundancy in facilitating reading comprehension, in terms of tense discrimination, for an aphasic subject. Although inconclusive, results support the trend in the literature regarding the value of such information. The results of this study also appear in agreement with some recent studies in aphasic alexia. Future studies might explore this experimental task, tense discrimination, with a less severely impaired subject, or with a group of

subjects ranging in impairment levels. Different reading tasks might also be investigated.

Implications for training and therapy may be taken from this study. If, despite a severe reading impairment, this subject could derive benefit from semantic redundancy, other subjects might benefit even further. Tenses might be trained with the additional markers, in a highly redundant condition. Markers could be faded as the client's ability to use morphology improves. In view of the results regarding child literature, controls in the area of verb aspect appear warranted in training with redundancy. Further investigation is needed to support the evidence of this study, and explore areas not probed.

References

Bloom, L., Lifter, K. and Hafitz, J. Semantics of verbs and the development of verb inflection in child language. Language , 1980, 56 , 386-412.

Calvanio, R., and Levine, D. The neurology of reading disorders. In A. Arbib, D. Caplan, and J. Marshall (Eds.), Neural models of language processing . New York: academic Press, 1982.

Carrow, E. Test for Auditory Comprehension of Language. Austin: Learning Concepts, 1973.

Ferguson, G. Statistical analysis in psychology and education . New York: McGraw Hill Co., 1971.

Gardner, H., Albert, M., and Weintraub, S. Comprehending a word: The influence of speed and redundancy on auditory comprehension in aphasia. Cortex , 1975, 11 , 155-162.

Gardner, H., and Zurif, E. Critical reading of words and phrases in aphasia. Brain and Language , 1976, 3 , 173-190.

Goodglass, H., Blumstein, S., Gleason, J., Hyde, M., Green, E., and Stahender, S. The effect of syntactic encoding on sentence comprehension in aphasia. Brain and Language , 1979, 7 , 201-209.

Kertesz, A. Aphasia and associated disorders . New York: Grune and Stratton, 1979.

Lahey, M., and Feier, C.D. The semantics of verbs in the dissolution and development of language. Journal of Speech and Hearing Research , 1982, 25 , 81-95.

Lund, N.J., and Duchan, J.E. Assessing children's language in naturalistic contexts . New Jersey: Prentice Hall, 1983.

Marshall, J.C., and Newcombe, F. Patterns of paralexia: A psycholinguistic approach. Journal of Psycholinguistic Research , 1973, 2 , 175-199.

Perfetti, C. Interactive processes in language and reading disability. Paper presented at Conference on Language, Learning and Reading Disabilities, City University of New York, 1981.

Pierce, R. A study of sentence comprehension of aphasic subjects. In R. Brookshire (Ed.), Clinical Aphasiology: Conference Proceedings . Minneapolis: BRK Publishers, 1979.

Pierce, R. Facilitating the comprehension of tense related sentences. Journal of Speech and Hearing Disorders , 1981, 46 , 364-368.

Pierce, R. Facilitating the comprehension of syntax in aphasia. Journal of Speech and Hearing Research , 1982a, 25 , 408-413.

Pierce, R. Decoding syntax during reading in aphasia. Manuscript submitted for publication, 1982b.

Stachowiak, F.J., Huber, W., Poeck, K., and Kerschensteiner, M. Text comprehension in aphasia. Brain and Language , 1977, 4 , 177-195.

Thorndike, E.L., and Lorge, I. The teacher's word book of 30,000 words . New York: Teacher's College Press, 1944.

Van Demark, A., Lemmer, E., and Drake, M. Measurement of reading comprehension in aphasia with the RCBA. Journal of Speech and Hearing Disorders , 1982, 47 , 288-291.

Von Stockert, T. R., and Bader, L. Some relations of grammar and lexicon in aphasia. Cortex , 1976, 12 , 49-60.

Webb, W.G., and Love, R.J. Reading Problems in Chronic Aphasia. Journal of Speech and Hearing Disorders , 1983, 48 , 164-170.

Wilcox, M.J., Davis, G.A., and Leonard, L.B. Aphasics' comprehension of contextually conveyed meaning. Brain and Language , 1978, 6 , 362-377.

Appendix A

Training items :

1) The big fish is swimming.
2) The dog is in the car .
3) The girl is standing.
4) The basket has flowers .
5) The boy is runnung .
6) The girl is drawing.
7) The sheep is in the water .
8) The car is sitting .
9) The boy is reading .

*NOTE--the target items in the training sentences were not underlined. This has been done here to indicate which were the salient items in each sentence.

Appendix B

1) Experimental verbs: go, write, eat, sit, sleep, fix, look, jump, ride.

2) Semantic redundancies:

a. Present tense--Right now.
b. Past tense--Already.
c. Future tense--Soon.

Sentence presentation--Day 1 and 4:

1) The girl wrote the letter.
1a) Right now the girl writes the letter.

2) The girl ate the food.
2a) Right now the girl eats the food.

3) The girl sits in the chair.
3a) Soon the girl will sit in the chair.

4) The girl will jump over the fence.
4a) The girl already jumped over the fence.

5) The girl will look out the window.
5a) The girl already looked out the window.

6) The girl will go into the house.
6a) The girl already went into the house.

7) The girl rides the horse.
7a) Soon the girl will ride the horse.

8) The girl sleeps in the bed.
8a) Soon the girl will sleep in the bed.

9) The girl fixes the train.
9a) Soon the girl will fix the train.

Sentence presentation--Day 2 and 5:

1) The girl will write a letter.
1a) The girl already wrote a letter.

2) The girl will eat the food.
2a) The girl already ate the food.

3) The girl will fix the train.
3a) The girl already fixed the train.

4) The girl jumps over the fence.
4a) Soon the girl will jump over the fence.

5) The girl looks out the window.
5a) Soon the girl will look out of the window.

6) The girl goes into the house.
6a) Soon the girl will go into the house.

7) The girl rode the horse.
7a) Right now the girl rides the horse.

8) The girl slept in the bed.
8a) The girl already slept in the bed.

9) The girl sat in the chair.
9a) Right now the girl sits in the chair.

Sentence presentation--Day 3 and 6:

1) The girl writes a letter.
1a) Soon the girl will write a letter.

2) The girl eats the food.
2a) Soon the girl will eat the food.

3) The girl will sit in the chair.
3a) The girl already sat in the chair.

4) The girl jumped over the fence.
4a) Right now the girl jumps over the fence.

5) The girl looked out the window.
5a) Right now the girl looks out the window.

6) The girl went into the house.
6a) Right now the girl goes into the house.

7) The girl will ride the horse.
7a) The girl already rode the horse.

8) The girl will sleep in the bed.
8a) The girl already slept in the bed.

9) The girl fixed the train.
9a) Right now the girl fixes the train.

*NOTE--sentences were presented randomly each day.

An observation of the phonology of black English speaking children

Doreen Fisher
Ann Jablon*

Abstract

This study examined the nature of the relationship between BE dialect and articulation disorders. In addition, the authors were interested in determining if the subjects exhibited the ability to code-switch and, if so, to what degree did this obscure their disorders? The results indicated that the subjects exhibited different speech patterns from young normal Standard English (SE) speakers or young delayed SE speakers. When the subjects were compared to young speakers of BE they exhibited more similarities. Both subjects demonstrated the ability to code- switch on the basis of color; one subject was sensitive to the factor of authority. The clinical guidelines are discussed.

There has been relatively little research published about the emerging phonology of Black English (BE) speaking children. Even fewer investigations have been directed toward the nature of the relation between an emerging BE dialect and articulation disorders. Researchers have reported that the reason for this limited information stems from the fact that most descriptive studies of BE phonology have focused on adults, adolescents, and children who have acquired the adult system. This paucity of empirical observations leave us with no valid normative reference for assessing articulatory proficiency among young black children (Seymour and Seymour, 1981).

Researchers into the phonology of black speakers have reported that BE is a systematically rule-governed linguistic system (Moulton, 1976; Labov, 1972; Burling, 1973; Williams and Wolfram, 1972; Wolfram and Fasold, 1974). These investigators have identified some of the phonological aspects of BE: reduction of word-final consonant clusters ending in a stop; /θ/ → /f/ substitution in medial and final word positions; /ð/ → /d/ substitution in initial and medial word positions; devoicing of /b/, /d/, and /g/ in final word positions; /v/ → /b/ in the initial and medial word position; and the omission of the medial and final /r/ and /l/.

Empirical observations of young black children's speech have drawn upon limited spontaneous speech samples, and have isolated for investigation a few features designated as BE (Seymour and Seymour, 1981). Using a standard articulation test with both black and white children, Seymour and Seymour found that omissions consisting primarily of stop consonants comprised much of black children's errors in the final word position. In 1967, Raph observed the same pattern. The authors stated that since the consonant cluster and devoicing rule of BE relate strictly to final word position stop consonants, it was hypothesized that the deletion of final word position consonants was a precursor to devoicing and consonant cluster reduction. This posited a BE influence on developmental features and could account for the higher incidence

*Faculty Supervisor

of final word position omissions among black children. It was found that despite dialectal background, four-and-five year old black and white children produced essentially the same developmental errors, but the black chidren produced a greater number of errors that characterized BE phonology. The authors noted, however, that there was little doubt that differences between the speech of young BE and Standard English (SE) speakers were greater than what the study revealed. It was suggested that qualitative differences between the speech would appear more dramatically in contrasts between spontaneous speech samples of the two groups rather than contrasts of single word utterances.

Ratusnik and Koenigsknecht (1967) claimed that for black children age had a strong effect on non-standard performance for seven linguistic measures: (1) postvocalic /θ/; (2) prevocalic and intervocalic /θ/; (3) prevocalic, intervocalic, and postvocalic /v/; (4) prevocalic /ð/ (5) intervocalic and postvocalic /ð/; (6) negation; and (7) third person singular morphological markers -s -z. Younger children were found to be more nonstandard than their older counterparts. Black children of lower social status were found to employ non-standard features with greater frequency than blacks of middle social status.

Due to the uniqueness of BE phonology, it is necessary to take into account a child's sound system when assessing phonological performance. The purpose of assessing phonological performance is to determine whether one is mastering or has mastered the sound sytem of the language. Williams and Wolfram (1977) stated that if one has mastered the language system of one's community, regardless of language or dialect, this articulation falls should be considered within normal limits. The authors suggested that speech-language pathologists use the phonological rules of the speaker's own dialect as the norm in order to distinguish between speech disorder and dialect. In the absence of normative data on child BE phonology, Seymour and Seymour (1977) suggested that through screening of black children, the clinician may acquire knowledge about the developmental linguistic patterns of the children within their communities.

Bountress and Hayes (1982) stated that numerous problems persist with regard to erroneous diagnosis and inappropriate educational placement of speakers of BE. They reported that linguistically-biased test results were the principal reason for the inflated incidence figures of speech and language disorders among blacks. The authors suggested that of educators must be to identify those biased aspects of diagnostic tools for a more accurate description of children's speech and language skills.

Bountress and Rochelle (1982) noted that each year children from considerably diverse cultural backgrounds enter public schools and soon come into conflict with the different learning - living styles and speech and language patterns of the dominant culture. They indicated that as a result of this conflict, some children are placed in classes for the retarded, learning disabled, and speech and language disordered. Bountree and Rochelle noted that black children's performance on standardized language and achievement tests may produce by faulty teacher perceptions and placement problems. They suggested that the clinician should play a critical role in clarifiying the influence of dialectal interference in classroom settings.

In addition to limited information about emerging BE phonology and its influence on children who are exhibiting articulation disorders little is known about children's ability to code-switch. Researchers have identified

cond-switching as an integral part of the communicative behavior of many blacks (Moulton, 1976; Seymour and Seymour, 1977). Style switching or code-switching involves the alternate use of different styles of speaking. This phenomenon is not unique to BE vernacular, but it is an important dimension of normal communication behavior within the black community. Moulton (1976) found that speakers of BE may use sound systems differently from thos of SE when they speak informally. Their pronounciation may come closer to that of SE as they speak more formally. The degree to which style switching of adults is mirrored in children's speech is not clear. However, style switching is likely to occur more among adults that children and amoung the more educated than the less educated.

The fact that there is limited information about the emerging phonology of black children bears on issues that arise in speech-language pathology. Clinicians working in public schools and clinics misdiagnose linguistic and phonological differences as deviances. Assessments of articulatory efficiency must be done with an understanding of the differences in BE from SE. In addition, speech-language clinician must be aware of the biases inherent in standard assessment measures used to screen BE speaking children.

The present observational study was designed to address whether phonological disorders revealed patterns that were dialectally related but could be misconstrued as articulation errors. In addition, a secondary focus of this study was to determine if code-switching occurred among the subjects.

Method

Subjects :

The subjects were two black male children who were enrolled at the Queens College Speech and Hearing Center in group articulation therapy. Both children were diagnosed at their initial interview as exhibiting multiple articulation errors chracterized by substitutions and by the omission of word final consonants.

Subject A J., age 6.9, was a highly verbal child with age-appropriate lexical and syntactic skills. With regard to articulatory functioning the prognosis was good as he was extremely stimulable on error sounds given auditory and visual cues. J. was enrolled in a first grade class within the public school system and did not receive any special services.

SubjectB , S., age 6.10, was diagnosed at the initial interview as exhibiting a possible learning disability in addition to a severe phonological impairment. At the time of this study he had auditory perceptual problems and below age level receptive language functioning. The Peabody Picture Vocabulary Test was administered in March 1982 and indicated a receptive vocabulary age of 5.5 years, placing S. in the 12th percentile for his age. On the Test for Auditory Comprehension of Language, S. performed at the level of a four year old. No formal testing of his expressive language skills were done prior to this study due to S's unintelligibility. S.'s motor skills were depressed; he was immature in gross and fine motor coordination.

Both subjects were given a screening modification of the Carrow Elicited

Language Inventory (CELI) (Hemingway, 1981) prior to data collection. The modification consists of 20 sentences selected from the original test to differentiate young BE speakers from children with true language disorders (see Appendix A). Each child was screened individually by the black examiner.

J. made seven errors placing him with children who spoke SE (The SE group produced less than nine errors). J.'s errors were all dialectal variations. S. produced 22 errors placing him on the borderline between the group of children who spoke BE (produced between 10 and 21 errors) and the children who had a language disorder (an average of 32.4 errors).

Apparatus

The experiment was conducted in a 10' x 15' room at the Queens College Speech and Hearing Center. All sessions were audio-tape recorded on a portable cassette recorder.

Procedure

The two children were taped in three contexts: (1) speaking with a black examiner, (2) speaking with a white examiner, and (3) the two children speaking together. An interview about family and school information was conducted in the three contexts, on three separate days. Each context was taped for fifteen minutes.

To establish reliability the three tapes were phonetically transcribed by two experienced raters. Interjudge agreement was 1.0. When agreement could not be achieved for an utterance it was excluded. A third rater randomly selected ten utterances from each of the three tapes for transcrition. The result was .83 reliability among the three listeners.

Phonological analyses were performed on the utterances collected from the two children speaking together (100 utterances). Fifty utterances from the other two contexts were randomly selected to complete the analyses. Ingram's Phonological Process Analysis (1981) was performed (chosen because it has published SE norms). In addition, comparisons of these data were made to the Seymour and Seymour's (1981) results.

Results

An examination of the results of the process analysis indicated that 68.8% (J.) and 64.7% (S.) of the observed articulation errors were in fact BE. These features were further categorized as actual BE features, possible BE features (norstandard, but not exclusive BE), and developmental BE features. For S. and J. only 35.3% and 31.2% respectively of the observed errors were considered to be actual articulation errors (see Table 1).

Table 1

Results of the process analysis showing the breakdown of observed errors into dialect and actual articulation errors.

Category	J.	Percentage of Observed Errors	S.	Percentage of Observed Errors
Actual BE Features	d/θ[1] d/f[1] -/z[3] -/ə/ɹ[3] -/l[3]	37.5	d/θ[1] d/f[1] -/z[3] t/θ[3] -/s[3] -/l[3]	35.3
Possible BE Features	d/θ[2] n/ŋ[3] ʔ/t[2]	18.8	d/θ[2] n/ŋ[3]	11.8
Developmental BE Features	-/d[3] -/t[3]	12.5	-/d[3] -/t[3] -/g3	17.6
Articulation Errors	k/ʃ[2] -/d[1] w/r[1] θ/s[2] d/v[3]	31.2	-/r[1] -/v[3] -/l[2] -/ŋ[3] d/v[3] f/v[2]	35.3

According to Seymour and Seymour, the process which separate the children are omissions (deletion of consonant stops), and substitutions (labilization, loss of aspiration and gliding). Both J. and S. used these two processes in their speech. The white children were characterized by labilization in the initial position. Neither subject used this process. The white children also used gliding. J. demonstrated this procss in his speech.

The data in Table 2 reveal that five of the processes found in the data from 15 language-delayed children (at a functional level of 1.6 - 2.0) are unique to this group and three to the 15 normal children between the ages of 1.5 and 2.2 as identified by Ingram (1981).

In terms of processes used by delayed children, J. used only stopping of initial voiceless fricatives and the affected target sound was a different /θ/ for J. and /f/ and /s/ for the delayed group. S. used the process of FCD of voiced fricative with the same affected target sound /z/. Additionally, this subject used the process of stopping of initial voiceless fricatives with the affected target sound being /θ/, the same as for J.

In terms of the processes used by the normal children, J. used the process of deletion on initial consonants, but again the affected target sound differed, /d-/ for our subject and /h-/, /w-/, and /s-/ for the normals. J. and S. also used the process of voicing, but the affected target sound was different - /-θ/, /-θ-/ for J. and /k-/, /p-/, /t-/ /k-/, /s-/ for normals.

Table 2

Comparison of subjects to delayed and normal SE speaking children.*

	Affected target sounds			
Phonological Processes	Normal	Delayed	J.	S.
1. Used by Delayed Only				
a) FCD of voiced fricatives		-z	-	+
b) Cluster reduction of nasals		NC voiceless	-	-
		NC voiced	-	-
c) Unstressed syllable deletion		(6 subjects)	-	-
d) Stopping of initial voiceless fricatives		f-, s-		
e) Apicalization		f-	-	-
2. Normal Only				
a) Deletion of initial consonants	h-, w-, s-		d-	-
b) Velar assimilation	d-		-	-
c) Voicing	k-, p-, t- -k-, s-			

*Adapted from Ingram (1981)

The highest percentage of overall errors for blacks (70.6), whites (82.8) and for J. (86.6) were substitutions. For S., omissions constituted the highest percentage of overall errors (52.1). The 28.0, 38.7, and 40.0 percentage substitutions in the initial word position for black and white children and for J. respectively comprised the largest percentage of total errors among the three word positions. Again, S. varied. The greatest percentage of total errors occurred in the final word position, with 34.4 percentage omissions. The black and white children demonstrated a similar percentage of errors for distortions. Neither subject in the study distorted consonant sounds on this standard articulation test. The percentage of total omissions was greater for blacks, S. and J. than whites,(16.5%,52.1%, 13.4% respectively compared to 5.5%). Seymour and Seymour (1981) found that ommissions consisting primarily of stop consonants comprised much of black children's errors in the final word position. This finding was not true for J. who included the final stop consonants.

J. was able to code-switch in the three contexts and did so in a hierarchy. The greatest number of BE features were observed when J. was

speaking to a black peer (70%). J. produced 56% BE features when speaking with a black adult and 50% when speaking with a white adult. With S., 72% of BE features were produced with a black adult and a black peer. When speaking with a white adult, 44% of the observed features were BE.

Discussion

The present study was designed to determine whether two black children diagnosed as having phonological impairments were exhibiting dialectic patterns that could be misconstrued as articulation errors. The results of this investigation demonstrated that the majority of the subjects' observed speech patterns were dialectally related. Thus, while these subjects did have a phonological disorder, the high percentage of BE features identified revealed the influence of dialect on their emerging phonologies.

Comparing the subjects to the profile of errors among four-and-five year old children (Seymour and Seymour, 1981) J. and S. exhibited several processes which were characteristic of young black children. When the subjects were initially screened, one of the outstanding features of their speech was deletion of final stop consonants. This deletion is hypothesized to be a precursor to devoicing and consonant cluster reduction. The influence of BE is expected to affect the developmental feature and would not respond to remediation.

The loss of aspiration in w/wh substitution is a questionable feature because it is common to other American dialects. Frequently this feature is examined with the use of a standard articulation inventory. Since this process is prevalent among young black children, it may be considered a diagnostic indicator of BE dialect, not to be remediated.

Although omissions consisting primarily of stop consonants comprise a large number of errors in the final word position in the Seymour and Seymour study, this feature could not be identified in J.'s speech with a traditional articulation test. This process, however, was evident in more extensive analyses. The articulation test obscured the fact that J. was in the process of developing a dialect. On the other hand, a child like S. who demonstrates a generalized delayed profile was not able to compensate phonologically. Given a standard articulation test he revealed unusual speech patterns. S. differed from J. and both black and white children in terms of type and number of errors.

Substitutions comprised the highest percentage of overall errors for blacks, whites, and J. Omissions comprised the highest overall errors for S. Additionally, the word position for greatest percentage of total errors differed. For J., the black and the white children, the initial word position comprised the highest percentage of errors, while the final position constituted the largest percentage of errors for S.

The secondary finding which emerges from this study differentiated the subjects on code switching. The data suggested that the children seemed to be aware of when it was appropriate to alter their dialectic features. For J. color and his perception of the black examiner as an authority figure appeared to play a role in his ability to code-switch. J. produced more BE features when he was speaking to S., a black peer. J. used less BE features when interacting with a black adult, and the least BE features occurred when

speaking with a white examiner.

S. seemed to be using different factors to determine when it was appropriate to code-switch. For S. the same percentage of BE features were observed with a black peer and a black adult. S. appeared to use color as his criteria. The black examiner seemed to be related to in terms of color, not authority. When speaking with a white examiner, there was a decrease in the percentage of BE features. S. did not appear to be as efficient a code-switcher as J. and was bound by his dialect.

It is apparent from these findings that some young children who are exhibiting delays have the knowledge of when to code-switch and will try to accomodate the interactor. However, a child's proficiency at altering his speech patterns will make him appear more or less severely impaired in different contexts.

Continued efforts should be made to identify those aspects of sound production that will alert the clinician to the presence of a dialect. A process analysis should be performed prior to therapy to determine which features of a child's speech are articulation errors and which are dialectally related. Future research should be directed toward systematic development of guidelines and establishing normative data for determining articulatory proficiency of BE speakers. In addition, efforts should also continue to examine the effects of code-switching on BE speakers who are delayed phonologically. This information would allow the clinician to appropriately identify and plan intervention for these children.

References

Bountress, N.G., and Hayes, J.M. An Examination of Linguistic Bias in the Flurharty Screening Test. Paper presented at the American Speech and Hearing Association Convention , Toronto, Canada, 1982.

Bountress, N.G., and Rochelle, M.K. Initial Results from an Elicited Imitation Black Dialect Screening Test. Paper presented at the American Speech and Hearing Association Convention in Toronto, Canada, 1982.

Burling, R. English in Black and White . New York: Rinehart and Winston, Inc. 1973.

Elbert, R.E. Some Observations on the Phonological Assessment of Hispanic American Children. Journal of the National Student Speech-Language-Hearing Association , 10, 44-54, 1982.

Hemingway, B.L., Montague, J.C., and Bradley, R.H. Preliminary Data on Revision of a Sentence Repetition Test for Language Screening with Black First Grade Children. Language, Speech, and Hearing Services in Schools , 12, 153-159, 1981.

Ingram, D. Phonological Disorders in Children . New York: Elsevier, 1976.

Ingram, D. Procedure for the Phonological Analysis of Children's Language , Baltimore: University Park Press, 1981.

Khan, L.M. A Review of Sixteen Major Phonological Processes. Language, Speech, and Hearing Services in Schools , 13, 77-85, 1982.

Labov, W. Language in the Inner City: Studies in the Black English Vernacular . Philadelphia: University of Pennsylavania Press, 1972.

McReynolds, L.V., and Elbert, M. Criteria for Phonological Process Analysis. Journal of Speech and Hearing Disorders , 197-204, 1981.

Moulton, W.G. The Sounds of Black English . In Harrison, D.S., (Ed.) Black English: A Seminar . Hillsdale: New Jersey: Laurence Erlbaum Associates, 1976.

Newcomer, P.L., and Hammill, D.D. The Test of Language Development . Austin Texas: Empiric Press, 1977.

Pollack, E., and Rees, N.S. Disorders of Articulation: Some Clinical Applications of Distinctive Feature Theory. Journal of Speech and Hearing Disorders , 37, 451-461, 1972.

Raph, J.B. Language and Speech in Culturally Disadvantaged Children: Implications for the Speech Clinician. Journal of Speech and Hearing Disorders , 32, 203-214, 1967.

Ratusnik, D.L., and Koenigsknecht, R.A. Influence of Age on Black Preschoolers Nonstandard Performance on Certain Phonological and Grammatical Forms. Perceptual Motor Skills , 42, 199-206, 1976.

Seymour, H.N., and Seymour, C.M. A Therapeutic Model for Communicative Disorders among Children who Speak Black English Vernacular. Journal of Speech and Hearing Disorders , 247-256, 1977.

Seymour, H.N., and Seymour, C.M. Black English and Standard American English Contrasts in Consonantal Development of Four-and Five-Year-Old Children. Journal of Speech and Hearing Disorders . 46, 274-280, 1981.

Weiner, F.D., Lewnau, L.E., and Erway, E. Measuring Language Competency in Speakers of Black American English. Journal of Speech and Hearing Disorders . 48, 76-84, 1983.

Williams, R., and Wolfram, W. Social Dialects: Differences versus Disorders. (Ed.) I.K. Jeter, Rockvill, Md.: ASHA , 1-31, 1972.

Wolfram, W., and Fasold, R.W. The Study of Social Dialects in American English . Englewood Cliffs, N.J.: Prentice Hall, 1974.

Appendix A

Screening modification of the CELI

Original sentences and sentences used by the subjects. Sentences marked with an asterisk remained unchanged. Each subject was told to repeat each sentence after the examiner.

Subject A

1. The big green ball is mine.*
2. Both balls are bigger than mine.*
3. The girl is not happy where she lives.
   The girl is not happy where she live .
4. Bill isn't coming to school.*
5. The children don't play do they?*
6. The boy is jumping because it is fun.*
7. Couldn't daddy have been coming?
   Couldn't daddy be have coming?
8. She has been running.
   She have been running.
9. Mother had seen the paper.
   Mother have seen the paper.
10. The cat is up in the tree.*
11. Mother gave the ball to her.*
12. Whose puppy is black and whit?
    Whose puppy (____) black and white?
13. Where are the dolls>
    Where are the doll ?
14. Didn't the man see the book?*
15. The train is bumped by the car.*
16. Mother told me to play in the house.*
17. If it rains we won't go to the beach.*
18. He puts the paper down.
    He put the paper down.
19. The tree is between the houses.*
20. The dog is under the house.*

Subject B

1. The big green ball is mine.
   The bik green ball is mine.
2. Both ball are bigger than mine.
   Both balls is bigger than mine.
3. The girl is not happy where she lines.
   The girl is not happy where he live
4. Bill isn't coming to school.
   Bill not coming to school.

5. The children don't play do they?
   The child don't play do dey ?
6. The boy is jumping because it is fun.*
7. Couldn't daddy have been coming?
   Could her daddy (____) (____) coming?
8. She has been running.
   He have been running.
9. Mother had seen the paper.
   Mother have seen the paper.
10. The cat is up in the tree.
    The cat is up down the tree.
11. Mother gave the ball to her.*
12. Whose puppy is black and white?
    Who puppy is black and white?
13. Where are the dolls?
    Where is the doll?
14. Didn't the man see the book?
    Didn't (____) man see the book?
15. The train is bumped by the car.*
16. Mother told me to play in the house.*
17. If it rains we won't go to the beach.
    If it rain we won't go to the beach.
18. He puts the paper down.
    He pit the paper down.
19. The tree is between the houses.
    The tree is 'tween to the house .
20. The dog is under the house.*

Assessment of the directional microphone hearing aid in the clinical setting

Robin J. Knapp
James Dempsey*

Abstract

The amount of front-to-back ratio provided by directional microphone hearing aids (DMHA) has been specified on Knowles Manikin for Auditory Research (KEMAR) in an anechoic chamber. This experimental paradigm attempts to develop a standard clinical procedure to measure front-to-back ratio on human subjects in an acoustically treated sound suite, through the use of Bekesy audiometry. The front-to-back ratios of three DMHAs were determined by using ten hearing impaired adults and an aided sound-field, pulsed tone Bekesy procedure with the tones presented at 0 and 180 azimuth. The amount of front-to-back ratio was determined by computing the numerical difference between the two tracings. The experimental findings revealed statistically significant differences between three test aids which were in good agreement with the manufacturer's measures. The experimental procedure proved to be a sensitive measure to assess front-to-back ratio on human subjects in a typical clinical setting.

Until recently, the hearing aid industry employed an omnidirectional microphone as a standard component in all manufactured hearing aids. This microphone arrangement is equally sensitive to sound from all directions (Nielsen, 1973; Lentz, 1973; Frank and Gooden, 1975; Sung, Sung, and Angelelli, 1975; Kemp, 1975). In 1971, the American market introduced the directional microphone hearing aid (DMHA), and amplification system for difficult listening situations. The DMHA is constructed to be more sensitive to sounds that originate from the front of the listener than to sounds from other directions.

The directional microphone contains two inlets, one in the front and one in the rear. A damping effect is introduced when sounds enter from the rear. The sounds arriving from behind are attenuated by an acoustical delay element resulting in these sounds being less amplified than sounds originating from the front (Sung, et.al., 1975; Kemp, 1975).

Researchers have conducted numerous studies, in various testing situations, to compare the effectiveness of the DMHA with its omnidirectional microphone hearing aid (OMHA) counterpart. The majority of these investigations have shown the DMHAs to be significantly superior to the OMHAs under various listening conditions. The possible advantages of a directional hearing aid seem obvious, however many issues remain unresolved. The DMHA is not in widespread use as may be expected based on the results of these studies (Mueller, 1981).

A possible explanation for the lack of use of the SMHA may lie in the difficulties involved in measuring its electroacoustic characteristics.

*Faculty Supervisor

Measuring and specifying the electroacoustical characteristics of the DMHA as been performed in manufacturer's laboratories utilizing KEMAR (Knowles Electronics Manikin for Acoustic Research) in an anechoic chamber. Measuring the characteristics of this instrument poses problems with attempting to measure its directional feature acoustically in the clinical setting. Routine evaluation of the functioning of the DMHAs cannot be made accurately in the stanadard aid test box environment because such a test box exposes the hearing aid to a relatively uniform sound pressure (Brey, Caustin, and McPherson, 1976). However, the measurements of the essential characteristics of the DMHA is possible when it is exposed to a source directed toward the aid from different azimuths. This condition is not possible using the conventional hearing aid test box. To date, a standard for measuring electroacoustical specifications of the DMHA in the clinical setting has not been developed. A standardized clinical procedure to assess the DMHA would be a key to more widespread use of the DMHA. The following investigations demonstrate the importance of broader usage of this type of nstrument.

A major advantage of the DMHA is that it reduces interference from bachground noise enabling the user to better receive the desired speech signal (Frank and Gooden, 1975). However, there are a number of factors that must be considered when testing the DMHA. Researchers have compared the DMHA to the OMHA in experimental evaluations under a number of conditions: 1) no compoeting noise, 2) monaural amplification with competing noise, 3) binaural amplification with competing noise, and 4) reverberent environments. In addition, these studies employed different independent variables, such as: 1) the azimuth(s) of the speech source, 2) the azimuth(s) of the noise source, 3) signal to noise (S/N) ratio, 4) front to back (F/B) ratios, and 5) variability among hearing aids.

It has been found that under the condition of quiet (signal presented with no competing noise) that the SMHA does not exhibit an advantage in performance over the OPMHA (Kemp, 1975). Lentz (1972) found that, speech discrimination scores were highly similzr in quiet using either type of aid worn on one or both ears. Kelly and Miller (1975) concurred with the above results in a similar comparison study. Kemp (1975) also found small differences between the two microphone types when comparing the ability to locate a sound source with no competing noise.

Based upon this lack of variation in the quiet condition, studies have been conducted in the presence of noise to demonstrate the DMHAs superiority over the OMHA. Frank and Gooden (1975) evaluated, under a monaural condition, speech discrimination scores between the two microphone ty[es as a function of multitalker noise and level. Twenty different normal hearing subjects were tested under each of the following three conditions: 1) competing noise at 0 azimuth, 2) competing noise at 180 azimuth, and 3) competing noise at bothe 0 and 180 azimuths. The speech material was presented at 45 azimuth. Signal to noise ratios of -18, -12, -6, and 0dB were utilized. No difference in discrimination scores were observed under the first condition. In condition two, the speech discrimination results were approximately 15% better at each of the S/N ratios tested, as well as for condition three at S/N ratios of -12, -6, and 0dB. These findings revealed that the DMHA reduces the background noise when the source originates from 180 or 0 and 180. This is exhibited by improved discrimination in difficult listening conditions.

Lentz (1972) tested twelve subjects with sensorineural hearing losses. Speech discrimination ability was assessed using recorded W-22 word lists in

the presence of competing cafeteria noise. The noise was delivered from five speakers situated at 60 intervals around the subjects. A signal to noise ratio of +6 was used and speech discrimination was tested under monaural and binaural conditions. Under the monaural aided condition, the DMHA performed slightly better than the OMHA in noise. Speech discrimination scores obtained using binaural amplification in noise were markedly better using the DMHA.

Sung, et.al. (1975) investigated the amount of directionality among three different brands of DMHAs. They compared the speech discrimination ability of thirty-two hearing impaired persons using directional and omnidirectional aids in competing noise. The test words (recorded W-22) were presented from 45 azimuth while the competing noise arrived from 45, 135, 225 and 315 azimuths. Full-on gain curves were obtained on each aid separately under each listening condition. The OMHA proved to be equally sensitive to sounds from all four directions measured in this study. It was found that directionality differed among the DMHAs. Findings indicated that the best discrimination scores were obtained through the DMHA that exhibited the greatest directional effect (front-to-back ratio) under the relatively difficult listening conditions.

The above studies compared speech discrimination abilities obtained through the DMHA to the OMHA. A comparison of the conditions employed by these researchers revealed a directional advantage. Similar results to those mentioned have been reported by McFarland and Moss (1973) and Mueller and Johnson (1976). Kelly and Miller (1975) did not concur with the above results. They compared the two microphone arrangments with the location of the noise source located at four different azimuths 0, 90, 180 and 270 degrees. The signal to noise ratio remained at a nominal 0dB. They compared the average discrimination scores for three different OMHAs to three different DMHAs with similar gain and frequency responses. The speech signal was fixed at 45 azimuth while each noise source location was individually tested. These researchers found that the DMHA results were slightly better when the noise was located at 90. However, when the noise originated from 0, 180, and 270 azimuths, the OMHAs demonstrated superior results, most significantly at 0 and 270 azimuths. Subsequently, this investigation revealed differences between the brands of OMHA and DMHA types, particularly for one DMHA which performed very poorly. This latter finding may have been accountable for the former findings.

Lentz (1973) reported that the amount of directionality differs significantly among the directional aids available on the market. Mueller and Johnson (1976) investigated the effects of various front-to-back ratios. Front-to-back ratio is the amount of amplification provided by an aid at 0 azimuth as compared to 180 azimuth.

Twenty-four subjects with bilateral sensorineural hearing impairments were tested while fitted with four different DMHAs. The front-to-back ratios at 1000Hz for the four aids were at 6, 10, 16, and 20dB. The speech signal was presented from a speaker located directly in front of the listener (0 azimuth) at set levels of 55, 65 and 75dBSPL with the S/N ratios being 0, -10, and -20dB. The competing noise was presented from a speaker located directly over the head of the subject, this location was selected to create the effect of surrounding noise. Each subject was tested with each of the four aids at the three different listening conditions. It was found that the intelligibility scores increased as the amount of rear attenuation (front-to-back ratio) increased. The attenuation provided by the DMHA with a front-to-back ratio of 20dB (measuring at 1000Hz) was optimal for understanding speech in a competing

noise situation. However, small increases in the front-to-back ratios, 10dB or less, did not yield a significant difference but showed a gradual score improvement.

The above study and the findings from Sung, et.al. (1975) research, reveal that the front-to-back ratio of the DMHA is an important variable and should be considered in experimental research. The front-to-back ratio of the DMHAs are measured using standard electroacoustical equipment in connection with KEMAR in an anechoic chamber. Electroacoustical specifications of the DMHA have not yet been developed in a clinical setting through the use of human subjects.

The purpose of this study was to develop a subjective clinical procedure to measure the front-to-back ratio of the directional microphone hearing aid in a standard audiometric test chamber through the use of Bekesy audiometry. This was accomplished by computing the differences of aided thresholds at two different azimuth (0 and 180) at 1000Hz. Basically the following two experimental questions were asked:

1) Will there be a significant agreement between the front-to-back ratios obtained in the clinicl setting and those specified on KEMAR in an anechoic chamber?

2) As front-to-back ratios increase, do speech intelligibility scores increase?

Method

Subjects

This study involved ten adult subjects with mild to moderate sensori-neural hearing impairments selected from the population tested at the Queens College Speech and Hearing Center. Each subject received a complete audiological evaluation to ensure that they met this criteria. In addition, all subjects were experienced users of amplification.

Apparatus

Three commercially available post-auricular directional microphone hearing aids were utilized in this study. These instruments include; 1) Starkey SD-1 (Aid A), 2) Siemens 232D-AGC-1 (Aid B), and 3) Oticon E24V (Aid C). Each DMHA contained similar frequency and gain characteristics with variant front-to-back ratios. The pulsed tones administered for audiometric trackings were generated by a Grason-Stadler Instrument (GSI-10 Bekesy audiometer).

The speech stimuli consisted of recordings of monosyllabic words (CID Test W-22). The W-22 materials were selected for this study because they are most commonly used stimuli for clinical evaluations (Martins and Forbis, 1978). The W-22 stimuli were played on a tape deck and the output was directed through the GSI-10 audiometer. Speaker locations in the test chamber were set at 0 and 180 azimuths. The audiometer was calibrated at several points throughout the study to ANSI-1969 standards and the testing was conducted in an acoustically treated sound suite.

Procedure

Each subject was seen on two separate occasions. The initial session included the aforementioned audiological evaluation as well as the subject's performance on one of three test instruments. The second visit entailed measuring the subject's performance with two of the remaining test DMHAs.

Speech recognition functions were obtained using recorded full (50) word lists from the CID Test W-22. The speech signal was presented from a speaker located directly in front of the listener (0 azimuth) while the competing speech noise arrived from 180 azimuth. Speech recognition was tested under a monaural aided condition with each of the three test instuments.

Computing the front-to-back ratios of each DMHA required each subject to trace their thresholds (250-4000Hz) from pulsed tones presented through soundfield sweep Bekesy trackings. The reliability and validty of soundfield pulsed Bekesy audiometry for assessing threshold information and amplification characteristics of hearing aids has been well documented (Green and Ross, 1968; McCommons and Hodge, 1969). The Bekesy parameters included intensity changes of 2.5dBHL/second, frequency changes at a rate of one octave/minute, with pulsed tones on for 200msec and off for 200msec. Each subject was given a hand-held response button that they were instructed to keep pressed when the test tones were present, and release when they were not. This testing was also conducted under monaural aided conditions which included wearing the three test aids each at 0 and 180 azimuth.

For all analyses of hearing aid performance, the following factors were controlled:

1) Subject was seated equi-distant from both speakers (approximately 3 1/2 feet) located at 0 and 180 azimuths.
2) Each instrument was adjusted to a most comfortable listening level (MCL) by having the subject adjust the gain dial to a male speaker's voice at 50dBHL.
3) Subject was instructed to visually fixate on an object located on the center of the speaker at 0 azimuth.

The first measurement obtained was the front-to-back ratio. The subject was instructed to trace his/her hearing soundfield thresholds, from 250Hz through 4000Hz, at 0 azimuth and 180 azimuth using the Bekesy tracking procedure. The front-to-back ratio was then determined by taking the numerical difference between the two tacings at 1000Hz. These computer front-to-back ratios were then compared to the front-to-back ratios provided by the manufacturers' of each DMHA.

The speech recognition task was performed using a fixed signal to noise (S/N) ratio of 0dB. The recorded speech material (CID Test W-22 lists 1A, 2A and 3A) was presented at a normal conversational level of 50dBHL at 0 azimuth while competing speech noise eminated from 180 azimuth at the same level. The subject was asked to write down, on an answer sheet, the word they heard. A word recognition score was compiled by computing the percent of correct responses out of 50. The recognition scores obtained with each instrument.

Results

The initial results on front-to-back ratio are shown in Table 1.

Table 1

A comparison of front-to-back (F/B) ratios obtained on KEMAR and using the subjective procedure.

	Aid A	Aid B	Aid C
F/B re:	28 dB	20 dB	12 db
F/B re: Subjective Procedure	13.2 dB	11.4 dB	4.6 dB

The pattern of front-to-back ratios seen between the DMHAs, as indicated by the manufacturers, is similar to measures obtained utilizing the aforementioned procedure. In each test environment, the greatest amount of rear attenuation was provided by Aid A, followed by Aid B, with Aid C providing the least amount of rear attenuation. This experimental procedure did not use KEMAR in an anechoic chamber, as did the manufacturer's, therefore, relative scores rather than exact scores are of importance. The experimental procedure was sensitive enough to show relative differences between each test instrument which are in good agreement with the manufacturer's measures. A repeated measures analysis of variance (ANOVA) procedure indicated that the average scores across hearing aids were significantly different from one another ($F=8.37$; $df=2.18$; $p<.01$).

The correlations obtained between speech recognition scores and amount of front-to-back ratio provided by each test aid were not statistically significant. The lack of variation in speech recognition scores appears to be related to the level of difficulty of the 0dB signal-to-noise ratio paradigm.

Discussion

As previously mentioned, when the directional microphone hearing aid is compared to its omnidirectional microphone hearing aid counterpart, it demonstrates significant advantages across electroacoustic, behavioral, and subjective measures. However, the DMHA is not as widely used as may be expected based upon its apparent research advantages. One suggested reason for the relatively infrequent recommendation of the DMHA is the difficulty involved in measuring electroacoustic performance.

Knowles Manikin for Auditory Research (KEMAR) is utilized to assess the

precise directionality specifications of the DMHA in an anechoic chamber. Although these performance characteristics are important in terms of true measurement of directionality, they do not provide the examiner with information regarding the amount of front-to-back ratio that will be experienced on a particular human subject. The typical audiometric test booth is partially reverberent and therefore not able to provide precise directionality measurements. For this reason, the present investigation attempted to develop a subjective procedure for evaluating relative differences in front-to-back ratio in the typical audiometric test booth.

The results of this study suggest that the pulsed-tone Bekesy procedure is an effective means for making relative directionality measurements on human subjects ins the clinical setting. Unlike the manufacturer's specifications, the measurements obtained on individual subjects can demonstrate the interaction between the listener and different DMHAs.

Intersubject variability with a single hearing aid has long been recognized. Factors that account for this variability include head and body diffraction; microphone location; earmold characteristics; residual ear canal volume; middle ear impedance; and the response criteria of the listener (Hawkins and Haskell, 1982). For this reason, hearing aid performance has been measured on individuals and referred to as a functional measurement. For example, functional gain has been defined as the difference between an individual's aided and unaided thresholds to warble tone stinuli across frequency. Functional gain has also been viewed as an important consideration in the typical hearing aid evaluation. Likewise, the subjective measurement of front-to-back we are proposing in the present investigation may be viewed as a functional front-to-back ratio measurement. That is, functional front-to-back ratio may be defined as the difference between an individual's aided sound field thresholds at 1000Hz with the signal arriving from 0 and 180 azimuth.

The present results suggest that this procedure may be useful as an assessment paradigm for those patients who might possibly benefit form a DMHA. The examiner can select several DMHAs that would be best suited for the patient's hearing impairment and proceed to measure the amount of front-to-back ratio provided by each aid. Along with the patient's subjective impression of each instrument, the one that furnishes the greatest amount of front-to-back ratio for that patient can be used as additional support when selecting the proper amplification system.

Speech recognition functions were assessed on each subject with all three test DMHAs in an attempt to assess the relationship between the amount of front-to-back ratio and the ability to discriminate speech. This measure would demonstrate how a greater front-to-back ratio could benefit the subject in terms of their ability to understand speech better. The results obtained in this study revealed no statistically significant correlation between the speech recognition scores and the amount of front-to-back ratio provided by each test aid. The subjects recognition scores were relatively poor with each test aid. The possible explanation for this lack of variation in the recognition scores, is that the 0dB signal-to-noise ratio was too difficult a listening task for these hearing impaired subjects. It is recommended that further investigations be conducted with a more positive signal-to-noise ratio in order to explore the relationship between front-to-back ratios and speech recognition ability.

Brey, R.H., Caustin, Fr. E.I. and McPherson, J.H. Comparison of measurements of the characteristics of directional microphone hearing aids in an IAC test room and anechoic chamber. J. Am. Audiol. Soc. , 2, 173-181, 1977.

Frank, T. and Gooden, R.G. The effect of hearing aid microphone types on speech discrimination scores in a background of multitalker noise. Maico Audiol. Library Series , 11: Report 5, 1975.

Hawkin, D.B. and Haskell, G.B. A comparison of functional gain and 2cm3 coupler gain. Journal of Speech and Hearing Disorders , Vol. 47, pgs. 71-76, 1982.

Kelly, B.R. and Miller, B.B. A comparison of commercially available directional and non-directional hearing aids. Presented at the American Speech and Hearing Association Convention, Washington, D.C., 1975.

Kemp, L. The effect of directional microphone on directional hearing. Scand. Audiol. , 105-109, 1975.

Lentz, W.E. Speech discrimination in the presence of background noise using a hearing aid with a directionally-sensitive microphone. Maico Audiol. Library Series , 10: Report 9, 1972.

Lentz, W.E. Speech discrimination using directional hearing aids in the presence of multiple noise sources. Presented at the American Speech and Hearing Association Convention, Detroit, 1973.

Lentz, W.E. A survey of individuals who have utilized both directional and omnidirectional hearing aids. Presented at the American Speech and Hearing Association Convention, Las Vegas, 1974.

Martin, F.N. and Forbis, N.K. The present status of audiometric practice: A follow-up study. ASHA, 1978, 20, 531-541.

McFarland, W. and Moss, R. The effect of directionally sensitive hearing aid on the aided speech discrimination performance of hearing-impaired individuals. Presented at the American Speech and Hearing Association Convention, Detroit, 1973.

Mueller, H.G. and Johnson, R.M. The effects of various front-to-back ratios on the performance of directional hearing aids. Presented at the American Speech and Hearing Association Convention, Houston, 1976.

Mueller, H.G. Directional microphone hearing aids: A 10 year report. Hearing Instruments , 32(11) 18-20, 1981.

Nielsen, H.B. A comparison between hearing aids with directional microphone and aids with conventional microphone. Scand. Audiol. , 2, 173-176, 1973.

Utilization of the middle latency response measuring auditory sensitivity

Martha Jove-D'Amato
Marvin Mazor*

Abstract

The present study investigates the utilization of the middle latency response or MLR in evaluating auditory sensitivity. Thresholds to 500-Hz and 3000-Hz tone bursts were established in 10 normal hearing and 10 sensorineural hearing-impaired adults using the 40-Hz event-related potential (ERP) reported by Galambos, Makeig and Talmachoff (1981). The 40-Hz ERP thresholds approximated audiometric thresholds at 500-Hz, with a mean SL of 15.5 dB in the normal group and -2.5 dB in the sensorineural group. The 40-Hz ERP was more variable at 3000-Hz in both groups. Clinical application of the 40-Hz ERP in children is discussed.

Computer averaging techniques make it possible to record electircal brain responses to auditory stimuli on the human scalp. These electrical brain potentials, known as the averaged electroencephalic response (AER), consist of several components. The early component or brain stem evoked rsponse (BSER) is the most widely used clinically (Vivion, 1980). The BSER is elicited in the first 8-10 msec after stimulus onset. It presumably arises from the VIIIth cranial nerve and brain stem, and is made up of 7 vertex-positive waves. In evaluating auditory sensitivity to stimuli, particular emphasis is placed on wave V or Jewett V.

Vivion (1980) summarized the audiologic and neurologic applications of BSER. Its audiologic value lies in the assessment of auditory sensitivity in individuals who can not be tested with conventional audiometry. This may include neonates, infants, young children, children with malformations of the external ear or meatus, malingerers, the deaf-blind, the mentally retarded, and the multiple-handicapped. In its neurologic application, BSER is used in the diagnosis and localization of lesions along the auditory pathway, particularly in the differentiation between cochlear and retrocochlear lesions.

Researchers of the AER have identified clinical limitations associated with BSER. Davis and Hirsch (1979) indicated that Jewett's wave V is a reliable and sensitive index when using simple and filtered clicks or tone bursts at 2000-Hz or higher, but is no longer reliable or sensitive near threshold below 1000-Hz. Their study supports the use of a slow negative component (SN10) as a substitute for Jewett V at 500 and 1000-Hz.

Two other responses, the frequency-following response (FFR) and the middle latency response (MLR), have also been proposed as alternatives for assessing low frequency auditory sensisitivity. The FFR is characterized by response peaks occuring at intervals corresponding to the period of the stimulus frequency (Moushegian, 1973). The MLR appears after the BSER with a commonly ascribed latency range of 8-50 msc. It is comprised of 5 negative and positive peaks- No, Po, Na, Pa, and Nb. Evidence for the auditory cortex and thalamus as origins for the MLR are presented by Kaga, Hink, Shinoda, and Suzuki, (1980) and Ozdamar, Kraus, and Curry (1982).

*Faculty Supervisor

Investigations by different groups have demonstrated that the MLR is a useful and valid index for audiological assessment. Thorton, Mendel and Anderson (1977) reported that MLR peak latency decreased with increased stimulus frequency, and amplitude growth occured with increased sensation level (SL). McFarland, Vivion, and Goldstein (1977) reported that MLRs of normal hearing and hearing-impaired subjects to 500, 1000 and 3000-Hz stimuli at various SLs. Similar MLRs were found for both groups, however, the hearing-impaired group showed greater amplitudes overall. The decrease in peak latency with increased frequency observed in normal hearing subjects was not obtained in the hearing-impaired group.

Recent studies have evaluated the relative sensitivity of both the MLR and BSER near threshold. Kavanagh, Harker, and Tyler (1984) determined BSER and MLR thresholds to a 500-Hz tone pip in normal hearing subjects. They found lower MLR response thresholds to the tone pips than BSER thresholds. A threshold of 26 dBnHL was obtained for BSER wave V, while MLR waves Na, Pa and Nb had thresholds of 10-11 dBnHL. Their study examined the effects of analog filtering on these waveforms. MLR response thresholds were minimally affected by varying the filter setting from 15-100-Hz to 15-3000-Hz. Yet lowering the bandpass setting of 100-3000-Hz to 15-3000-Hz resulted in greater BSER wave amplitudes and lower BSER thresholds. They attribute this to the growth of wave V or the inclusion of MLR wave Po. Kavanagh, Harker and Tyler, (1984) suggest that the MLR wave Po may represent a highly filtered BSER when recording both responses simultaneously with an open filter (15-3000-Hz).

Previously, Musiek and Geurknik (1981) compared BSER and MLR at low SLs. They found that MLR waves were present more frequently at lower SLs than BSER waves. In addition, the MLR wave Pa was found to be the most sensitive wave, followed by the BSER wave V. While latencies were more consistent and predictable for BSER, MLR amplitudes were greater. In contrast, Ozdamar and Kraus (1983) concluded that BSER was a more sensitive measure in determining threshold than MLR. Using a wide bandpass filter setting (3-2000-Hz), that allowed simultaneous recordings of the MLR and BSER, the BSER wave V was more detectable at lower SLs than MLR. The discrepancies between both studies may be due to the different bandpass filters used (Kavanagh, et.al., 1984).

The effects of natural sleep and sedation on the MLR waveform have been shown to be minimal. Mendel, Hosick, Windham, Davis, Hirsh and Dinges, (1975) reported mean estimates of threshold for light sleep at 15 dBSL and when awake at 18.5 dBSL. These results agreed with Mendel (1974), who obtained responses at 10 dBSL for the "early components" (latency less than 50 msec). Ozdamar and Kraus (1983) found the MLR peaks Na and Pa unaffected by the sedatives chloral hydrate and diazepam.

Different objective methods of response identification have been employed by researchers of the MLR. Mendel (1980) described the compositing technique used by several authors. Different average waveforms in response to a given N (number of stimuli presentations) are added together to form one averaged response to a given N. The compositing technique helps resolve the problem of uncancelled background EEG activity that can not be filtered out prior to averaging, which often makes response identification at low SLs difficult. Vivion (1979) has emphasized the need for developing a totally objective method for identifying MLR and subsequent threshold determination.

Galambos, Makeig, and Talmachoff (1981) reported a method for displaying the MLR reliably and promptly. The series of negative and positive waves of

the MLR resemble 3 or 4 cycles of a 40-Hz sinusoid. These waves combine to form a single waveform when sound stimuli are presented at a rate of 40/sec. Galambos and his associates named this waveform the auditory 40-Hz event-related potential or 40-Hz ERP. The 40-Hz ERP exibits properties similar to the MLR. Response amplitude increases with intensity increase, and amplitude increase occurs rapidly near threshold. In addition, response amplitude drops as frequency rises and resposnse latency shortens. Galambos et.al. (1981) demonstrated that the 40-Hz ERP can be used to approximate behavioral thresholds of subjects.

A current goal of research has been to obtain a multi-frequency audiogram utilizing one or more of the AERs. The study to be discussed here investigates the use of the MLR in determining low frequency and high frequency auditory sensitivity. The 40/sec paradigm reported by Galambos et.al. (1981) is used to obtain MLR threshold estimates to 500 and 3000-Hz tone bursts in normal hearing and sensorineural hearing-impaired subjects. The 40-Hz ERP thresholds are compared to audiometric thresholds at 500 and 3000-Hz to determine how well the 40-Hz ERP approximates audiometric thresholds at these frequencies.

Method

Subjects

Twenty adults served as the subjects in this experiment. Only one ear was tested per subject. Ten normal hearing adults were selected on the basis of availability. All 10 had hearing threshold levels (HTLs) of 10 dB (re: Ansi, 1969) or better bilaterally, at the audiometric frequencies of 250, 500, 1000, 2000, and 4000-Hz. The ear to be tested was randomly selected. None of the subjects were experiencing otologic or neurologic disorders at the time of testing.

Ten adults with sensorineural hearing losses were selected from a routine clinical population at the New York University Medical Center, where they were being evaluated for neurologic-otologic disorders. HTLs in the test ear were 30 dB or poorer either at 500-Hz, 3000-Hz or at both audiometric frequencies. The sensorineural hearing-impaired group was heterogeneous, consisiting of subjects with high frequency, low frequency or relatively flat sensorineural hearing losses. The brain stem evoked responses or BSERs for all 10 sensorineural hearing-impaired subjects were considered to be within normal limits.

Apparatus

A Grason-Stadler Model 1701 audioimeter and TDH-49 headphones were used to obtain a behavioral audiogram for each subject. A Nicolet Model CA-1000 clinical averager with associated tone generator (Model NIC-1002), physiological amplifier (Model HGA-200A), noise masking module (NIC-1007A), and disk controller (Model DC-2000) were used to record auditory evoked potentials. Scalp electrodes were fixed to the vertex of the head, forehead, and both earlobes. Auditory test stimuli were delivered to the test ear through TDH-49 earphones mounted in aural domes. Scalp potentials were recorded ipsilaterally.

The test stimuli produced by the tone generator consisted of 500-Hz and 3000-Hz brief tone bursts (alternating polarity) of 6-msec duration (2-msec rise and fall with 2-msec plateau). The tone bursts were presented at a constant rate of 39.1/sec, with 500 presentations at each run. The bandpass

filter setting was 30-100-Hz. Sensitivity was set at + - 10mV. The time base was 75-msec.

Procedure

Each subject was tested in a sound treated room. Subjects were instructed to relax and lay back in a reclining lounge chair. Most recording was performed with subjects awake, but during certain periods of testing a subject may have been drowsy or in a light sleep.

A 40-Hz ERP threshold search was conducted separartely at both 500 and 3000-Hz. Two silent control runs were performed first to record the activity of the brain in the absence of auditory stimuli. The test stimulus was presented initially at 20 dBSL, relative to a behavioral threshold to the cone burst. When the response was identified, the intensity level was lowered 10 dB. If no response was found, the intensity level was raised 5 dB. Response identification depended on whether the following criteria were met:

1. The response resembled the 40-Hz sinusoid reported by Galambos, et.al. (1981), with 3 or 4 sine waves occuring at 25-msec intervals.

2. The response was replicated in the second run at the same SL.

3. The 40-Hz sinusoid was characteristically distinct from the averaged responses recorded in the silent runs.

Test runs were performed until a 40-Hz ERP threshold was established or until a final 50 dBSL presentation level was reached. All 40-Hz ERP thresholds were verified by the second experimenter. Each test run was stored in a computer disc and plotted on a data card for later analysis.

A behavioral audiogram was used to compare audiometric thresholds at 500 and 3000-Hz to the 40-Hz ERP thresholds at these frequencies for each subject. The audiograms were obtained at the New York University Medical Center within 6 months of the testing date. A complete audiogram, including thresholds at 500 and 3000-Hz, were obtained by the experimenters when one was not available.

Results

The 40-Hz ERP threshold estimates were compared to the audiometric thresholds at 500 and 3000-Hz in both groups. The mean SL (re: the audiometric threshold) and standard deviation for the 40-Hz ERP thresholds are presented in Table 1.

Table 1

Mean SL (re:the audiometric threshold) and standard deviation for the 40-Hz ERP threshold.

Group	Frequency	Mean SL	S.D.
Normal	500-Hz	15.5 dB	7.84
Sensorineural		-2.5 dB	10.29
Normal	3000-Hz	34. dB	15.28
Sensorineural		5.4 dB	17.05

At 500-Hz the 40-Hz ERP was repeatable and clearly identified in both groups. The mean SLs for the 40-Hz ERP threshold in the normal and sensorineural groups were 15.5 dB (SD=7.84) and -2.5dB (SD=10.29) respectively. The group means were significantly different as determined by a t-test for independent means ($t=4.40$, $df=18$, $p<.01$). At 3000-Hz the 40-Hz ERP displayed generally poorer morphology than at 500-Hz, making response identification more difficult at this frequency. The mean SL for the 40-Hz ERP threshold was 34 dB (SD= 15.28) in the normal group and 5.4 dB (SD= 17.05) in the sensorineural group. These means were significantly different ($t= 3.95$, $df= 18$, $p<.01$). That there was more intersubject variability is indicated by their larger standard deviations.

Table 2 shows the mean SL (re: the audiometric threshold) and standard deviation for the tone burst thresholds.

Table 2

Mean SL (re: the audiometric thresholds) and standard deviation for the tone burst threshold.

Group	Frequency	Mean SL	Standard Deviation
Normal	500-Hz	6 dB	5.16
Sensorineural		-5.5 dB	6.85
Normal	3000-Hz	-3.5 dB	4.74
Sensorineural		-18.5 dB	5.30

At 500-Hz the mean SL for the tone burst threshold was 6 dB (SD= 5.16) in the normal group and -5.5 dB (SD=6.85) in the sensorineural group. The mean SL for the tone burst threshold at 3000-Hz was -3.5 dB (SD= 4.74) in the normal group and -18.5 dB (SD= 5.30) in the sensorineural group. The mean SLs for both groups were significantly different at 500-Hz ($t=4.24$, $df=18$, $p<.01$) and 3000-Hz ($t= 6.67$, $df= 18$, $p<.01$).

When the 40-Hz ERP thresholds were considered relative to the tone burst thresholds, the mean SLs for both groups are not significantly different. In Table 3 the mean SL (re: the tone burst threshold) was 9.5 B (SD= 10.12) in the normal group and 3 dB (SD= 3.43) in the sensorineural group at 500-Hz. The means were not found to be significantly different (t= 1.56, df= 18, p<.01).

Table 3

Mean SL (re: the tone burst threshold) and standard deviation for the 40-Hz ERP threshold.

Group	Frequency	Mean SL	Standard Deviation
Normal	500-Hz	9.5 dB	10.12
Sensorineural		3 dB	8.43
Normal	3000-Hz	37.5 dB	12.70
Sensorineural		23.9 dB	17.19

At 3000-Hz the mean SL was 37.5 dB (12.70) in the normal group and 23.9 dB (SD= 17.19) in the sensorineural group. Again the difference between the means was not significant (t= 2.01, df= 18, p<.01).

Discussion

The purpose of this study was to investigate the clinical use of the MLR in approximating audiometric thresholds at 500 and 3000-Hz, utilizing the 40-Hz ERP reported by Galambos, Makeig and Talmachoff (1981). At 500-Hz thr 40-Hz ERP threshold estimates the normal group were established at a mean SL of 15.5 dB relative to the audiometric threshold and 9.5 dB relative to the tone burst threshold. The mean SL in the sensorineural group was -2.5 dB relative to the audiometric threshold and 3 dB relative to the tone burst threshold. These results were consistent with Galambos and his associates, who found that of 7 normal hearing subjects all had 40-Hz ERPs at 15 dB and 10 dBSL to tonal stimuli and all but 2 had 40-Hz ERPs at 5 dBSL. In addition, these findings are in agreement with Mendel (1974) who obtained responses at 10 dBSL with the "early components" (latency less than 50-msec) in sleeping subjects, and Mendel and Goldstein's (1975) study in which mean threshold estimates of 15 dB were found in subjects in light sleep and 18.5 dB in awake subjects.

At 3000-Hz the 40-Hz ERP threshold estimates were generally obtained at SLs greater than those reported by Galambos, et.al. (1981). In the normal group the mean SL was 34 dB relative to the audiometric threshold and 37.5 dB relative to the tone burst threshold. The mean SLs in the sensorineural were 5.4 dB relative to the audiometric threshold and 23.9 dB relative to the tone burst threshold.

When the mean SL for the 40-Hz ERP threshold was considered relative to the audiometric threshold, both groups differed significantly. In contrast, when they were considered relative to the tone burst threshold the groups were not significantly different. This appears to be related to the groups' differences in sensitivity to the tone burst stimuli. The tone bursts utilized in this study were very brief with center frequencies of 500 and 3000-Hz. While a major concentration of the energy was present at or near their respective nominal frequencies, the frequency spectra of the tone bursts extended above and below the center frequencies. The mean SLs for the tone burst threshold (re: the audiometric threshold) in the sensorineural group were -3 dB at 500-Hz and -18.5 dB at 3000-Hz. These thresholds may actually reflect better sensitivity at frequencies below the center frequency, especially in subjects with sloping high frequency losses. The tone burst thresholds established in the sensorineural group may be explained to some extent by the spectrum of the test stimuli.

Our findings show that the 40-Hz ERP approximates audiometric threshold within 20 dB at 500-Hz. It was elicited reliably in both normal and sensorineural hearing-impaired adults with consistent morphology. The 40-Hz ERP may be useful to the clinical audiologist in providing information regarding low frequency auditory sensitivity in the absence of other audiological data. The 40-Hz ERP appears less useful at 3000-Hz due to its poorer morphology, higher sensation levels anfd intersubject ariability. However, as the number of subjects was limited to 20, its use can not be ruled out until larger samples are studied. In addition, the application of more frequency specific tone bursts may result in 40-Hz ERPs closer to audiometric threshold.

Clinical use of the MLR, utilizing the 40-Hz ERP, may be limited to adults. A study by Davis, Hirsh, and Turpin (1983) demonstrated that the MLR was depressed in children sedated with secobarbital or chloral hydrate and offers no advantage to AER audiometry in this population. They found that the slow negative component or SN10 was more clearly identified at lower SLs than the MLR. These findings were similar to Shallop and Osterhammel (1983), who found that the SN10 was more readily detected at lower SLs in sleeping newborns than the "40/sec MLR" using click stimuli. Both conditions elicited lower thresholds than the "40/sec MLR" threshold for a 500-Hz tone burst, which was established at a mean level of 37 dB. The BSER wave V and the slow negative component SN10 appear to be the best indicator waves as they remain unaffected by sleep and sedation in newborns and children.

At this time there is also some question as to the generator sources of the MLR obsereved in children. Mendelson and Salamy (1981) looked at the effects of maturation on MLR waveform, amplitude and latency. They recorded MLRs in premature infants, newborns and 3-4 year olds, with waveforms similar to those of adults in the 8-50-msec range. Response amplitude increased with age up to early childhood, and decreased in adulthood. While latency effects were found for the Po component, this component was considered synonymous with BSER wave V due to the effect of more restrictive filter bandwidths used in MLR. Since a decrease in latency as a function of age has been demonstrated for the early and late responses, Mendelson and Salamy (1981) conclude that the absence of age effects on MLR latency indicates a need for further investigation into the neurologic origin of the MLR.

References

Davis, H., and Hirsch, S.K. A slow brain stem response for low frequency audiometry. Audiology , 1979, 18,445-461.

Davis, H., Hirsh, S.K., and Turpin, L.L. Possible utility of middle latency responses in electric response audiometry. Advances in Otology-Rhinology-Laryngology , 1983, 31, 208-216.

Galambos, R., Makeig, S., and Talmachoff, P.J. A 40-Hz auditory potential recorded from the human scalp. Proceedings of the National Academy of Sciences USA , 1981, 78, 2643-2647.

Kaga, K., Hink, R.F., Shinoda, Y. and Suzuki, J. Evidence for a primary cortical origin of a middle latency auditory evoked potential in cats. Electroencephalography and Clinical Neurophysiology , 1980, 50, 254-266.

Kavanagh, K.T., Harker, L.A., and Tyler, R.S. Auditory barin stem and middle latency responses. Annals of Otology, Rhinology, and Laryngology , 1984, 93 (Suppl 108), 1-12.

McFarland, W.H., Vivion, M.C., and Goldstein, R. Middle components of the AER to tone-pips in normal-hearing and hearing-impaired subjects. Journal of Speech and Hearing Research , 1977,20, 781-798.

Mendel, M.I. Influence of stimulus level and sleep stage on the early components of the averaged electroencephalic response to clicks during all night sleep. Journal of Speech and Hearing Research , 1974, 17, 5-17.

Mendel, M.I. Clinical use of primary cortical responses. Audiology , 1980, 19, 1-15.

Mendel, M.I., Hosick, E.C., Windham, T.R., Davs, H., Hirsh, S.K. and Dinges, D.F. Audiometric comparison of the middle and late components of the adult auditory evoked potentials awake and asleep. Electroencephalography and Clinical Neurophysiology , 1975, 38, 27-33.

Mendelson, T. and Salamy, A. Maturational effects of the middle components of the averaged electroencephalic response. Journal of Speech and Hearing Research , 1981, 24, 140-144.

Moushegian, G., Rupert, A.L. and Stillman, R.D. Scalp-recorded early responses in man to frequencies in the speech range. Electroencephalography and Clinical Neurophysiology , 1973, 35, 665-667.

Musiek, F.E., and Geurkink, N.A. Auditory brain stem and middle latency evoked response sesnitivity near threshold. Annals of Otolaryngology , 1981, 90, 236-240.

Ozdamar, O., and Kraus, N. Auditory middle-latency responses in humans. Audiology , 1983, 22, 34-49.

Ozdamar, O., Kraus, N., and Curry, F. Auditory brain stem and middle latency responses in a patient with cortical deafness. Electroencephalography and Clinical Neurophysiology , 1982, 53, 224-230.

Shallop, J.K., and Osterhammel, P.A. A comparitive study of measurements of SN-10 and the 40/sec middle latency responses in newborns. Scandinavian Audiology , 1983, 12, 91-95.

Thornton, A.R., Mendel, M.I., and Anderson, C.V. Effects of stimulus frequency and intensity on the middle components of the averaged auditory electroencephalic response. Journal of Speech and Hearing Research , 1977, 20, 81-94.

Vivion, M.C. Clinical status of evoked response audiometry. The Laryngoscope , 1980, 90, 437-447.

Vivion, M.C., Wolf, K.E., Goldstein, R., Hirsh, J.E., and McFarland, W.H. Toward objective analysis for electroencephalic audiometry. Journal of Speech and Hearing Research , 1979, 22, 88-102.

Mother-child interactions with a language disordered child

Maureen Kelly
Renee Hochman Kornet*

Abstract

This observational study was designed to investigate mother-child interactions with a language disordered child. Data was analyzed with regard to the following questions: First, how do the interactions with this mother-child pair compare to mother-child interactions within the normal population. Second, do various styles of input, mother versus clinician, affect the verbal output of the child. Qualitative and quantitiative differences were found in the mother and clinician dyads. Analysis of the data also revealed that the child's language behaviors varied in response to the different input of speakers.

Current research in developmental psycholinguistics has begun to focus on the linguistic environment of the language learned. Investigations of the interactions between mothers and their children have led to some interesting findings. It has been suggested that speech to children acquiring language appears to function as a well designed set of language lessons. The sentences of adults to young children have been shown to be shorter in length and to contain fewer complex constructions and semantic notions than those found in adult to adult speech (Snow, 1972; Phillips, 1973). In addition, the speech of adults to children tended to be fluent, well-formed and highly repetitious (Snow, 1972). The speech of adults to children learning language appeared to be a simplified version of adult to adult speech. This simplicity was reflected in the low incidence of subordinate clauses and reduced mean length of utterance (Phillips, 1973; Snow, 1972). Snow noted that on the basis of her research, children learning language have available to them a sample of speech which is simpler, more redundant, and less confusing than normal adult to adult speech.

Observations of mothers with their children reveal patterns of interaction analogous to more complex conversational models. It has been observed that mothers are interested in maintaining social interactions and assume that their children are attending to them. According to Snow (1977) mothers interact with their children using a conversational paradigm. Snow posited that this fact may account for the high frequency of questions in mothers' speech to children. These questions may serve as a device for passing the conversational turn to the child. In addition mothers attempt to maintain social interactions by providing feedback when communicative breakdowns occur (Snow, 1977). Bates (1971) noted that mothers are found to dominate and direct mother-child conversations by "second guessing" the young child's communicative failures . Underlying these interactions between mother and child is the mother's desire to maintain communications and to communicate reciprocally with the child (Garcia, 1977; Newport, Gleitman, & Gleitman, 1977). There is evidence to

*Faculty Supervisor

suggest that this is true even in mother-infant exchanges. Infants have been observed demonstrating mutual gaze patterns with their caretakers which have been described as analagous to the rhythms in adult dialogue (Bateson, 1975; Jaffe, Stern, & Perry, 1973). Jaffe, et al (1973), reported that "a highly articulated conversational pattern characterizes the gaze behavior of the babbling period." It appears that the structure of these interactions between mother and child are equivalent to conversation (Bateson, 1975).

Some of the mother-child research has concentrated specifically on the effects of mothers'speech on the developing language system of the child. While research has shown that mothers modify their speech in significant ways when talking to their children, the effects of these speech style modifications is far from clear. One effect that can be measured is the rate of language acquisition. It is known that children learning language vary in the speed in which they acquire their linguistic ability. Several researchers have contended that the modifications that mothers make have a direct effect on the rate of acquisition.

Cross (1978) investigated a number of maternal speech variables and their effect on overall rate of linguistic acquisition. Syntactic, semantic, and pragmatic features of the mothers' language were examined. It was found that mothers of accelerated language learners as opposed to "slow learners" provided input that was contingent upon the child's previous utterances. These mothers provided input that matched the child's semantic intention. Their utterances were contingent upon or semantically related to the child's previous utterances. In addition, mothers of accelerated children used more repetitions of the children's preceding utterances. Repetition, it was felt, gave the children more of a chance to understand what was being said. Cross concluded that maternal speech may be more facilitative if it encoded those semantic relations that the child produces and is related to his ongoing activity. Mothers who more frequently expanded their children's utterances were more likely to have linguistically accelerated children.

Snow (1979) looked at ten mother-child pairs with seventeen month old children. In analyzing maternal utterances Snow modified Cross' coding system. Here it was similarly found that 68% of maternal utterances were semantically related to either the child's previous utterance or to the child's ongoing non-linguistic activity.

Ringler (1978) examined the effects of input on the acquisition process in a longitudinal design involving ten mother-child pairs. Ringler observed that mothers' speech to children was different than that addressed to adults. In addition it was noted that the language used with children changed after they began to talk. Ringler concluded that children's speech was probably influenced by the mother's speech and the mothers' speech was in turn influenced by changes in the child's linguistic ability.

Most of the research in this area has concentrated on only one participant in the dyad. To better understand the effects of input on the child other studies have looked at both participants in the interaction and their interrelationships. Bloom, Roscissano, and Hood (1976) looked at interactions between adults and young children. In particular these researchers investigated the discourse abilities of normally developing children. They reported that during Brown's Stages I and II the children's utterances were more often adjacent (directly following the adult's utterance) rather than being related or contingent upon the adult's prior utterance. In addition to

these findings it was noted that the use of questions by the adults appeared to facilitate the child's production of contingent utterances.

A study by Lieven (1978) looked at the conversational interactions between two mother-child pairs. Both mothers used more imperatives and interrogatives and less subordinate clauses to their children. Yet there were some significant differences found between the two mother-child pairs. It was found that one mother was more responsive to her child's utterances. This child spoke slowly and coherently about things in the environment. The second mother, in contrast, was less responsive and the child in turn spent more time trying to engage her mother in conversation. Lieven proposed that children may be influencing the way adults speak to them.

There have been relatively few studies which examine mother-child interactions with the language disordered population. Cramblit and Siegal (1977) looked at the verbal environment of a language impaired child. The input of three adults was analyzed. It was found that the adults' speech patterns to the language impaired child were different than their speech patterns to a normal child. The adults' speech to the language impaired childhad a lower type token ratio, and a smaller mean length of response. They reported that these findings were similar to the kinds of adjustments that mothers make when speaking to younger language learning children. Similar results were also found in a study by Lasky and Klopp (1982).

Research investigating differences in adult language to impaired children as compared to normals has resulted in some significant findings. Some researchers reported that language to impaired children tended to include more commands, fewer comments on ongoing activities and greater use of language for controlling the child than for real communicative interaction (Giattino, 1980). Giattino investigated the interactions between a mother and a language impaired child. Findings indicated a departure from normal mother-child interactions. The mother's input was characterized by a rapid usurpation of conversational turns (e.g., in that she did not wait for the child to respond), production of run-on complex sentences, and frequent interruptions.

Newhoff, Silverman, and Millet (1980) compared the interactions between mothers of language impaired and normal children. Eighteen dyads were examined. Children from both the normal group and the language impaired group were matched on the basis of MLU. The researchers reported that there were no differences in the amount of speech generated by the two groups of mothers or by the children. However other qualitative differences were found. It appeared that the mothers of the language impaired children were different from the mothers of the normals in that they used fewer semantically related responses to their child's utterances. In addition there were more unintelligible utterances apparent in the mothers of the language impaired children. A study by Grossfeld and Geller (1980) reported similar findings. In their study, parent's speech to a language impaired child was often not at all semantically related to the child's ongoing activities.

Wulbert, Ingles, Kriegman, and Mills (1975) looked at parent-child interactions with language delayed children and compared them to mother-child interactions with normal children and Down's syndrome children. Maternal input to the language impaired children was found to be different as compared to the other two groups. It was reported that mothers of language impaired children were often unresponsive to the child's verbal and non-verbal output.

The purpose of the present study was to investigate mother-child interactions with a language disordered child. This study was of observational design and attempted to answer the following questions: 1) How do mother-child interactions with a language disordered child compare to interactions reported within the normal population. 2) How do various styles of input affect the communicative style of the child. In particular the language behaviors of the mother, child, and clinician were analyzed with respect to semantic, syntactic and pragmatic features to determine the effects of input.

Method

Subject :

Subject J., was a 5.10 year old language impaired child. He had been enrolled at the Queens College Speech and Hearing Center for 3 1/2 years. Initially therapy had concentrated on improving his expressive and receptive communicative abilities. His language at that time was characterized by one and two word utterances. Interactions with others was minimal and eye contact was virtually non-existent. The use of self repetitions was a prevalent communicative style. At the time of this study J.'s language was characterized by age-appropriate semantic-syntactic skills. Deficits were noted however, in his use of language. J. exhibited difficulties in maintaining a cohesive topic during a conversational exchange. Numerous topic shifts were evident and output at time appeared to be tangential and perseverative. Eye contact was absent.

Developmental history indicated that pregnancy was not full term. At the age of two it was noted that J. experienced febrile seizures. Neurological evaluations (4/78) conducted revealed sub-normal mental milestones, hyperactivity, and grossly normal neurological findings.

Apparatus :

The experimental procedure was conducted in a therapy room at the Queens College Speech and Hearing Center. Four contexts were selected for communication sampling: Context I, Sesame Street House; Context II, Leggo Farm; Context III, Books; Context IV, Snack Activity. Contexts were selected based upon subject familiarity. Contexts were chosen to provide a range of communicative activities commensurate with J's developmental level. In each context the adult and child were seated at a table.

All sessions were videotaped with a reel to reel Panasonic 3020 by one of the experimenters. The tapes were later transcribed by the other experimenter.

Procedure :

Communicative interactions were observed in four contexts and with the two adults: his mother and a clinician. The adults were instructed to interact with the child as they would in a natural play situation. Each context was presented for 15 minutes. Observations were made over a period of three weeks. A total of two hours of interactions were analyzed; one hour with J. and his mother and one hour with J. and the clinician.

A variety of analyses were completed to analyze both adult and child utterances. Adult utterances were analyzed according to Snow's (1979) (see Appendix A) coding system to determine the semantic relatedness of the adult's utterance to the child's previous linguistic or nonlinguistic activity. In order to categorize and describe the child's utterances a list of specific language behaviors was derived from Yudkovitz, Lewison, and Rottersman (1975) (see Appendix B).

Results

The relative proportions and frequency of utterances spoken by the adults and by the child in each communication dyad were calculated (see Table 1). The proportion of utterances spoken by the mother in all contexts (.73) was greater than that of the clinician (.52). J. produced a smaller proportion of utterances with his mother (.27) than with the clinician (.48). It appeared that an increase in the quantity of input affected the frequency of output by the child.

Table 1

The relative proportions and frequency of utterances for each speaker in the communication dyads.

Dyad	Speaker	Prop.	No of Utterances
I	Mother	.73	(742)
	Child	.27	(275)
II	Clinician	.52	(419)
	Child	.48	(381)

In terms of syntax, adult utterances were analyzed according to sentence types employed. Table 2 displays the relative proportions of three sentence types used by the adults. J's mother produced a greater proportion of questions and imperatives in all contexts than did the clinician. Analysis of the data revealed that 52% of the mother's utterances were questions and imperatives. In contrast, the clinician's utterances were primarily declaratives (.72) and only 28% of her utterances could be characterized as involving questions and imperative statements.

Table 2

Proportion of adult sentence types employed in all contexts

Sentence type	Mother (Child)	Clinician (Child)
Declaratives	.48	.72
Questions	.31	.21
Imperatives	.21	.07

The proportion of adult utterances that were semantically contingent on the child's previous linguistic or nonlinguistic activity is presented in Table 3. Self-repetitions of the adult's own previous utterances was also included in the data. Data was initially collected for each of the sampling contexts. Since no significant differences were found among the different contexts, data from all four contexts were combined. Fifty-eight percent (.58) of the mother's utterances as compared to eighty-nine percent (.89) of the clinician's utterances were contingent upon or semantically related to the child's linguistic and nonlinguistic activity. In addition it was noted that fifteen percent (.15) of the mother's utterances were self-repetitions where only .02 of the clinician's utterances involved self-repetitions.

Table 3

Proportion of adult's semantically related utterances

Utterance type	Mother	Clinician
Semantically related to child's previous nonlinguistic activity	.23	.18
Semantically related to child's previous linguistic activity	.35	.70
Semantically unrelated to child's previous linguistic and nonlinguistic activity	.28	.10
Repetition of adult's own utterance	.14	.02

In order to analyze the child's language behaviors with reference to his specific language disorder, a list was derived from Yudkovitz, Lewison, and Rottersman (1975). Table 4 represents those language behaviors that characterize J's speech in each context with his mother and with the clinician.

Table 4

Proportion of language behaviors that characterize the child's speech in each context

Language behaviors	Child-Mother	Child-Clinician
Context I: Sesame Street House		
Topic match	.52	.65
Tangentiality	.02	.11
Echolalia	.07	.02
Topic-comment mismatch	.17	.01
Excessive questioning	.15	.19
Neologisms	-	-
Fragmentation	.07	.02
Context II: Leggo farm		
Topic match	.52	.50
Tangentiality	.03	.05
Echolalia	-	-
Topic-comment mismatch	.07	.03
Excessive questioning	.36	.40
Neologisms	.02	.02
Fragmentation	-	-
Context III: Books		
Topic match	.47	.39
Tangentiality	.02	.03
Echolalia	.08	.30
Topic-comment mismatch	.06	.01
Excessive questioning	.37	.27
Neologisms	-	-
Fragmentation	-	-
Context IV: Snack activity		
Topic match	.60	.80
Tangentiality	-	.02
Echolalia	.05	-
Topic-comment mismatch	.23	.02
Excessive questioning	.07	.13
Neologisms	-	-
Fragmentation	.05	.03

Analysis of the data revealed that J's language behaviors may be characterized generally by a high proportion of topic-comment mismatch and excessive questioning. It was also noted that different contexts affected the type of language output generated by J. In the manipulative contexts, sesame street house, leggo farm, and snack activity J's language more often topically matched the ongoing topic or activity. The context involving books on the other had generated output which was less often topically appropriate.

Contexts were conflated so as to examine variations in the communicative dyads (see Table 5). Again, it was found that both topic-comment mismatch (.15) and excessive questioning (.27) were still the primary inappropriate language behaviors exhibited by J. in his interactions with his mother. These inappropriate behaviors were however less frequent in J's interactions with the clinician. In this instance topic-comment mismatch accounted for two percent (.02) and excessive questioning was twenty-four percent (.24).

Table 5

Proportion of language behaviors that characterize the child's speech in all contexts

Language behaviors	Child-Mother	Child-Clinician
Topic match	.51	.57
Tangentiality	.01	.05
Echolalia	.04	.11
Topic-comment mismatch	.15	.02
Excessive questioning	.27	.24
Neologisms	.004	.002
Fragmentation	.02	.01

Discussion

The present study was designed to investigate the interactions between a mother and a language disordered child. Various analyses were performed to determine the nature and effect of adult input on the verbal output of a language disordered child. On the most basic level of analysis, it was found that with an increase in the frequency of the adult's input there was a decrease in the verbal output of the child. It appears that since J's mother occupied most of the conversational exchange, the child was limited in terms of his output. J. had less of an opportunity to verbalize with his mother because of the high proportion of her utterances during an exchange. In contrast, the frequency of the child's verbalizations increased with a decrease in adult input. This was noted during interactions with the clinician. A decrease in the frequency of input appeared to give the child more of an opportunity to participate in the verbal interaction. It appears that differences in this instance affected the verbal output of the child.

This study also examined the types of sentences used by the adult speakers. J's mother frequently employed imperatives and interrogative forms in all of the communication contexts. This finding is consistent with literature on normal mother-child exchanges in which there is a high frequency of questions in mothers' speech to children (snow, 1977). It has been reported that questions are often used to pass the conversational turn to the child. In this study J's mother often used questions and imperatives to get the child's attention and to direct him to the ongoing activity. It was noted that J. was often unresponsive to his mother's verbalizations and she in turn would ask a series of questions in order to get the child to attend. This resulted in a question-response routine in which the mother initiated and directed the majority of the conversational exchange. The clinician, on the other hand, employed declarative sentences more frequently than did the mother while interacting with the child. This in turn may have provided the child with more of an opportunity to direct the activity himself.

Our results appear to be consistent with those reported by Giattino (1980) who also examined interactions between a mother and a language disordered child. In her study the mother of the language impaired child employed a high frequency of questions during the interaction. In doing so, she similarly directed and initiated the topic or activity.

Research focusing on mother-child exchanges has often looked at the semantic relatedness of the mothers' speech. As previously stated, it has been found that in most normal mother-child pairs, mothers' speech was often semantically related to their children's previous verbalizations or non-linguistic activity (Snow, 1977). It has been suggested that input which semantically matches the child's semantic intentions facilitates language growth. In contrast, research findings with language disordered children indicated that mothers of language disordered children often provide input that is not contingent or semantically related to the child's verbalizations. Newhoff, Silverman, and Miller (1980) found that mothers of language impaired children used fewer semantically related responses than did mothers of normal children. Grossfeld and Geller (1980) reported similar findings. They found that the clinician produced more semantically related utterances than did the mother. In addition the clinician's style of interacting was less directive. The authors suggested that in turn the child initiated more communicative acts

with the clinician than with the mother.

The results from the present study are consistent with findings on disordered mother-child pairs. The majority of the mother's utterances, as well as the clinician's, semantically matched the child's semantic intentions. Yet it should be noted that in many instances the mother controlled and directed the topic or activity by talking about her own activities and attempting to incorporate the child into the situation. Input from the clinician, as compared to the mother, contained a smaller proportion of semantically unrelated utterances.

In addition, in the mother-child dyad examined in this study, it was noted that the mother frequently employed the use of self-repetitions during the conversational exchange. As noted earlier J. was often unresponsive to his mother's verbalizations. It appears that the use of self-repetitions by the mother was an attempt to have the child attend and participate in the topic or activity. Lasky and Klopp (1982) noted that in their study the use of repetition by mothers was often used as a strategy when their children failed to respond to their verbalizations.

In terms of the child's inappropriate language behaviors, it was noted that J's language was characterized by excessice questioning and topic-comment mismatch. The frequency of these two language behaviors was higher when interacting with his mother, although J. was more echolalic with the clinician. The excessive use of questioning by the child is interesting in that it was found that the mother employed a large number of questions in her speech. J's language in all contexts appeared to be more appropriate with the clinician although this varied across the different contexts. On the basis of the preliminary data from this study, it appeared that different styles of input, mother versus clinician, affected the child's language. Our data suggests both quantitative and qualitative differences.

Further research is needed to examine mother-child interactions with respect to a variety of language disorders. The present study concentrated on the interactions of a mother and child wherein the child exhibited a specific disorder where his use of language was impaired. Perhaps the influence of input may vary as a function of the specific problems exhibited by the child.

Appendix A

Coding system for semantically related utterances from Snow, 1979.

1. Maternal utterance related to the child's activity

   a. to what he is looking at
   b. to what he is pointing to
   c. to an action he is carrying out

2. Maternal utterance related to the child's utterance

   a. Imitation, partial or complete of preceding child utterance
   b. Expansion of the child's utterance
   c. Semantic extension of the child's utterance
   d. Elicitation of words related to child's previous utterance

3. Maternal utterance not related to child's activity or utterance

4. Utterances that were repetitions of adult's own previous utterance

Appendix B

Definition of the Child's Language Behaviors

These language behaviors were adapted from literature by Yudkovitz, Lewison, and Rottersman, 1974

1. Topic match: Utterances produced by the child that matched or expanded upon the ongoing topic of conversation.

2. Tangentiality: Utterances produced by the child not directly related to the current topic.

3. Echolalia: Utterances produced by the child that were either immediate or delayed repetitions of the adult's utterance.

4. Topic-comment Mismatch: Utterances produced by the child that were not related to the topic of conversation: off topic.

5. Excessive Questioning: Questions produced by the child that he either knew the answer to or asked the question and provided the answer himself.

6. Neologisms: Utterances produced by the child that were invented by the child and were meaningless.

7. Fragmentation: Utterances produced by the child that were incomplete sentences.

References

Bates, E. The development of conversational skill in 2, 3 and 4 year olds. University of Chicago, 1971.

Bateson, M. C. Mother infant exchanges: the epigenesis of conversational interaction. In D. Aronson & R. Rieber (Eds.), Developmental Psycholinguistics and Communication Disorders. (Annals of the New York Academy of Science), 1975, 263, 101-113.

Bloom, L., Rocissano, L., & Hood, L. Adult-child discourse: Developmental interaction between information processing and linguistic knowledge. Cognitive Psychology, 8, 521-552, 1976.

Cramblit, N. S. & Siegel, G. M. The verbal environment of a language-impaired child. Journal of Speech and Hearing Disorders, 1977, 42, 474-482.

Cross, T. Mothers' speech and its association with rate of syntactic acquisition in young children. In N. Waterson and C. Snow (Eds.), The development of communication. New York: John Wiley & Sons, Inc., 1978.

Garnica, O. Some prosodic and paralinguistic aspects of language acquisition. In C. Snow & C. Ferguson (Eds.), Talking to children. New York: Cambridge University Press, 1977.

Giattino, J. Interaction between a language-insensitive mother and her language-impaired child. Paper presented at American Speech-Language-Hearing Association Convention, Detroit, Michigan, Nov., 1980.

Grossfeld, C. & Geller, E. Follow the leader: Why a language disordered child can't be 'it'. Working papers in experimental speech-language pathology and audiology, New York: Queens College of CUNY, 1980, 9.

Jaffe, J., Stern, D., & Perry, J. Conversational coupling of gaze behavior in prelinguistic human development. Journal of Psycholinguistic Research, 1973, 2, 321-329.

Lasky, E., Klopp, K. Parent-child interactions in normal and language-disordered children. Journal of Speech and Hearing Disorders, 1982, 47, 2-18.

Lieven, E. V. M. Conversations between mothers and young children: Individual differences and their possible implications for the study of language learning. In N. Waterson and C. Snow (Eds.), The Development of Communication. London: Wiley, 1978.

Newhoff, M., Silverman, L., & Millet, A. Linguistic differences in parents' speech to normal and language disordered children. Paper presented to symposium on child language disorders, Madison, Wisconsin, 1980.

Newport, E., Gleitman, A., & Gleitman, L. Mother I'd rather do it myself: Some effects and non-effects of maternal speech style. In C. Snow and C. Ferguson (Eds.), Talking to children: language input and acquisition. New York: Cambridge University Press, 1977.

Phillips, J. Syntax and vocabulary of mother's speech to young children: Age and sex comparison. Child develoment , 1973, 44 , 182-185.

Ringler, N. A longitudinal study of mother's language. In N. Waterson and C. Snow (Eds.), The development of communication , London: Wiley, 1978.

Snow, C. Mothers' speech to children learning language. Child Development , 1972, 43 , 549-565.

Snow, C. Mothers' speech research: From input to acquisition. In C. Snow and C. Ferguson (Eds.), Talking to children: language input and acquisition . New York: Cambridge University Press, 1977.

Snow, C. The development of conversation between mothers and babies. Journal of Child Language , 4 , 1-22, 1977.

Snow, C. Are parents language teachers? Paper presented at New York State Speech and Hearing Convention, New York, 1979.

Wulbert, M., Inglis, S., & Mills, B. Language delay and associated mother-child interactions, Developmental Psychology , 1975, 11 , 61-70.

Yudkovitz, E., Lewison, N., & Rottersman, J. Communication therapy in childhood schizophrenia: an auditory monitoring approach. Psychosocial Press: Issues in Child Mental Health, IV (1), 1975.

A learning disabled child's ability to request clarification of unclear messages

Lauren Cwenar
Elaine Geller*

Abstract

The purpose of this study was to compare a learning disabled child's ability to request clarification of unclear messages to two normal children-one matched on linguistic level and another on chronological age. Three different conditions were designed to elicit requests. The types of requests and the frequency of requests were examined. It was found that the learning disabled child requested clarification as often as the two normal children in two conditions. However, the learning disabled child did not use as many specific request types as the normals. Results obtained from a third condition revealed that the learning disabled child did not request clarification as often as the normal child matched on age, but requested with greater frequency than the normal child matched on linguistic level. Again, the learning disabled child used fewer specific request types. These data may indicate that the communication problems of learning disabled children may be the result of an interaction involving cognitive, social, and linguistic deficits. Clinical implications are discussed.

In recent years the study of pragmatics has led to increased interest in conversational abilities. In looking at this area, Rees (1982) breaks down conversation into five components: 1) the ability to follow the conventions of the sequential organization of conversation; 2) the ability to make coherent conversational contributions; 3) the ability to repair conversational errors; 4) the ability to use language to establish and vary social role; and 5) the ability to produce and comprehend a full range of speech acts. Research in pragmatics has shown that very young normal children are extremely sensitive to their conversational partners (Garvey, 1975), and are aware of and able to adapt to their listener's needs (Shatz and Gelman, 1973).

The area of communication breakdowns is of increasing interest among normal and learning disabled children because it is an aspect of communication which captures a range of conversational skills (including speech acts, adherence to one's conversational role, etc.) and highlights the reciprocal nature of discourse. Communication breakdown occur frequently within discourse. They usually involve the speaker's message not being understood by the listener. When this occurs it is the responsibility of the listener to request clarification of the unclear message. It is then the responsibility of the speaker to respond to the listener's request for clarification by revising his/her message so that discourse can proceed. The ability to initiate repairs and respond to communication breakdowns keeps the conversational exchange flowing.

Researchers have begun to focus on normal and learning disabled children's

*Faculty Supervisor

ability to use language to request clarification when given inadequate/unclear messages (Donahue, Pearl, and Bryan, 1980; Bryan, Donahue, and Pearl, 1981a, 1981b; Gale, Liebergott, and Griffin, 1981). Ironsmith and Whiteburst (1978) examined the ability of normal children from 5 to 12 years of age to request clarification of ambiguous or uninformative messages (messages were vague and specific referents were unclear). Each child was shown 20 sets of pictures which depicted the same object but differed in terms of binary features (e.g., four people, either big or little, with an antenna on top of their heads or without, with their mouths open or shut, arms spread out or at their sides, and legs apart or together) and were asked to select the correct picture based on clues given by the experimenter. Results revealed that the younger children were poor at requesting clarification of ambiguous or uninformative messages. When they did request clarification, they asked general or non-specific questions such as "I don't know which one it is?".

Using a revised version of the Ironsmith and Whitehurst context (1978), Donahue et.al. (1982) found that learning disabled children were less likely to request clarification or ask for additional information when messages were inadequate or uninformative. In comparison to normal children, they less frequently initiated the repair of a communication breakdown. The LD children had the linguistic ability to initiate requests bu did so less often. Donahue et. al. concluded that learning disabled children fail to understand their role as listeners. Their findings were consistent with previous research by Morehead and Ingram (1973) who found that language impaired children produce fewer questions than normal children. Morehead and Ingram hypothesized that these youngsters may exhibit some type of socio-linguistic deficit. Donahue, et.al. suggest the possibility that learning disabled children's failure to request more information may not be due to comprehension or production deficits of syntactic and semantic structure. Instead, they suggest that their decreased use of requests may be because they are less assertive and therefore play a less cooperative role in conversation.

Bryan, Donahue, Pearl, and Sturm (1981) looked at the L.D. children's conversational skills and found that learning disabled children were less skilled than normal children in initiating and maintaining conversation with peers. They found that they were less likely to ask questions of their peers, did not adapt to their listener's needs, and were less assertive and less effective conversational partners. Gale, et.al. (1981) also studied the frequency and manner in which learning disabled and normal children requested clarification. Younger subjects were matched on similar linguistic levels (about 2.5 morphemes). The subjects participated in a structured play activity during which they were asked to perform a series of actions. Their results inicated that the learning disabled children requested clarification as often as the normal children. However, they were deficient in the linguistic form of their requests. In other words, they used more nonverbal tactics to request clarification. It is interesting to note that in an investigation of young language impaired children, Snyder (1975) observed that the language impaired children more frequently used nonverbal means to express proto imperatives in spite of the fact that they had adequate linguistic abilities to express these requests verbally. More recently, Brinton and Fujiki (1982) studied normal and language disordered children's request-response sequences in natural child-child discourse in a play situation. They studied children between the ages of 5 and 6 years. It was found that the normals produced three times as many requests for clarification as the disordered subjects. The normal children were also much more likely to initiate repairs in conversation.

In sum, there is some conflicting evidence as to learning disabled children's abilities to effectively deal with communication breakdowns. Some researchers argue that learning disabled children do not request clarification as frequently as normals (Donahue, et.al. 1980; Brinton and Fujiki, 1982). Others argue that they do request clarification as often as normals (Gale, et.al., 1981). Different contexts and experimental methods may contribute to these conflicting findings. For example, Donahue, et.al. (1980) examined learning disabled children's ability to request clarification in a structured context, Gale, et.al. (1981) used a more natural discourse setting, and Brinton and Fujiki (1982) used a totally unstructured natural discourse context. Therefore, it appears that each context may have yielded the difference in results.

Several hypotheses have been proposed as to why learning disabled children have difficulty adapting to their listener's needs and initiating the repair of a communication breakdown. Bryan, et.al. (1981, 1981a, 1981b) raise three possible explanations for learning disabled children's conversational disabilities. First, their difficulties may be a reflection of deficits in linguistic structure. In other words, their linguistic deficits may account for their lack of question-asking. In addition, requesting clarification requires spontaneous production of a question which, in light of their linguistic deficits, may not be easy to do on demand. Second, learning disabled children's difficulty in adapting to their listener's needs may be the result of cognitive deficits. They cannot spontaneously use problem-solving skills when presented with difficult tasks and their failure to use task-efficient strategies may extend to the area of conversational strategies. Third, their conversational deficits may be the result of feelings of lower self-esteem and lower social status. Thus, they adopt a less assertive posture in conversation and permit their partners to assume the dominant role.

In sum, it is clear is that learning disabled children encounter many problems in pragmatic, syntactic, and/or semantic areas of discourse during everyday communicative interactions. Given the nature of their impairments, these children will probably find themselves on the giving or receiving end of a communication breakdown more frequently than normal children. This suggests that language clinicians need to carefully evaluate this area and deal with the child's unsuccessful communicative attempts (Wollner and Geller, 1982).

The purpose of this study was to examine the area of communication breakdown with a learning disabled child. This child's performance was compared to two normal children, one matched on chronological age and one matched on linguistic level. Specifically, we were interested in looking at the learning disabled child's ability to request clarification in a range of different communicative contexts. We were also interested in the types of repairs used and the frequency of occurrence of repairs when given a range of unclear messages. Further, we wanted to examine the possible patterns of request types used in relation to the type of unclear input presented to the child.

Based on our review of the literature we felt that the learning disabled child would request clarification less frequently than the normal child matched on age, and as frequently as the normal child matched on linguistic level. In addition, we felt that the learning disabled child would use more non-specific than specific linguistic request types. Thus, we postulated that an interaction of social and linguistic deficits would interfere with this youngsters pragmatic abilities in the area of communication breakdowns.

Subjects

H was a 9.4 year old male with a mean length of utterance (MLU) between 4.1 and 5.2 morphemes. H had been classified as learning disabled as a result of extensive neurological, psychological, and linguistic testing. Cognitive functioning, as assessed with the Wechsler Intelligence Scale for Children, revealed a borderline range of intellectual abilities. Neurological evaluations suggested signs of diffuse dysfunction which were neurologic in origin. His reading as measured by the Woodcook Reading Mastery Test revealed H to be functioning at approximately one year below age expectation. In spelling and arithmetic, H is also a year below grade level.

H demonstrated serious problems in the areas of form, content, and use. Formal language testing using the Test for Auditory Comprehension of Language (TACL) and the Peabody Picture Vocabulary Test (PPVT) revealed H to be functioning at a 6.8 to 6.10 year old language level. He demonstrated a range of communicative problems as well as morphological, syntactical, and lexical problems.

M was a 9.6 year old normal female enrolled in a regular 4th grade class in the public schools.

C was a 4.10 year old normal male enrolled in a preschool program with an MLU between 4.11 and 4.14 morphemes.

Apparatus

Experimental sessions were conducted in a 10' x 12' room at the Queens College Speech and Hearing Center. The experimenter (E) and subject (S) sat facing each other at a small table. In condition II a 12" x 20 " cardboard barrier was positioned between E and S in order to prevent them from seeing each others materials. Data for all conditions was collected by a second experimenter as well as audiotaped using a Panasonic RQ227 cassette recorder.

Condition I involved the use of 25 sets of colored drawings on 3" x 5" cards. Each set contained three pictures, each picture differing from the other by one or two attributes, (e.g., color and size).

Condition II involved the use of two Lego Universal Building Sets (#355), E and S each had their own set. Four large and four small legos of each color were left in the box. The remaining legos (including all medium size legos) were removed from the box. The windows which were differentiated by a white paper backing, the trees which were differentiated by a stop sign, remained in the box. The boys, the wheels, and the fences also remained in the box as is.

Condition III involved the use of two short stories presented orally to the child. Each story was at a 2.2 grade level. These stories were adapted from Culatta, Page, and Ellis (1983).

Procedure

Condition I (picture context) . This context was adapted from Ironsmith and Whitehurst (1978) and Donahue, et.al. (1980). Stimulus pictures for Condition I were presented twice in order to allow for 50 trials. Ten messages were clear and fully informative. The remaining 40 messages were unclear and broken down as follows: 5 ambiguous, 5 unintelligible, 15 uninformative, and 15 partially informative (see appendix A for definitions). The messages were randomly presented.

Each child was read the following instructions:

" We are going to look at some pictures.I am going to pick a picture and describe it to you, I will tell you what it looks like. Then I want you to show me the picture I described to you by pointing to it. Only one picture can be right. You must listen very carefully and pay attention. If I did not tell you enough for you to pick the right picture, ask me questions. Remember to listen carefully and ask questions".

Each child was then given two practice trials in order to heighten awareness of differences in the pictures. If the child was not able to point to the correct picture, the experimenter pointed it out and explained why it was the correct choice. If the child chose the correct picture, the rest of the trials were automatically presented.

Condition II (lego context) . Condition II allowed for 49 trials. Nine messages were clear and fully informative. The remaining 40 messages were unclear and broken down as follows: 14 ambiguous, 5 unintelligible, 6 uninformative, and 15 partially informative.

Each child was shown a model lego train that was specially designed for this context. Each child was then told that he or she was going to build the same train. The cardboard barrier was then placed between the child and experimenter. The child was given his or her set of legos. The experimenter labeled the different sizes, colors, and pieces with the child (ie: little red legos, big blue legos, door). This was done to heighten the child's awareness of the differences in size and color, and to bring attention to the other pieces included in the set.

Each child was read the following instructions: " You are going to make the same toy train that I have made. I am going to tell you how to make it but you have to listen very carefully. I will tell you which color and size legos to use and I will tell you where to put them. If I did not tell you enough for you to do it, ask me questions. Remember to listen carefully and ask questions".

Three practice trials were given to insure that each child was capable of differentiating between size and color. If the child was not able to choose the correct lego, the experimenter pointed it out and relabeled the set. If the child chose the correct legos, the rest of the trials were automatically presented.

Condition III (short story context) . Condition III contained no visual

or non-linguistic cues. This context was designed to capture a more natural discourse type of interaction where the adult input was presented continuously instead of in single sentences.

This condition allowed for 20 opportunities to request clarification. Twelve omissions, four unintelligible messages, and four neologisms were randomized throughout the stories (see appendix A for definitions).

Each child was read the following instructions:

" I am going to tell you a story. You must listen carefully and pay attention because you have to tell the story to someone who hasn't heard it. If there was something you didn't understand, ask questions because you have to retell it. Remember to listen and ask questions".

A short trial story that contained known characters from The Three Bears was then read to the child. The child was asked to retell the story to a naive listener. This was done to ensure that the child was listening and that he or she realized that all information was needed to retell the story correctly. If the child was able to point out the main characters and ideas of the story, the other two stories were presented. If the child had difficulty retelling the story he or she was questioned to see if the main ideas had been understood. If the ideas were comprehended the other two stories were presented.

In all contexts, the adult's response to the children's behaviors were as follows: First, if the child incorrectly responded or there was no response at all after hearing the message, the experimenter continued. Second, if the child requested clarification, the experimenter immediately gave a clear and fully informative message. Third, if the child requested clarification again, the message was repeated. Only the child's first request for clarification was recorded.

In order to control for an order effect and subject fatigue and variation from day to day, conditions were randomized over three days. Conditions I and II were begun on day one, Condition III was begun and Condition I was completed on day two, and Conditions II and III were completed on day three. To keep the children motivated they were allowed play time and/or given a small prize between Conditions.

Results

The results from Conditions I and II were combined for all subjects as shown in Table 1. As can be seen the learning disabled child's overall ability to request clarification of unclear messages was as frequent as both normal children. In fact, the learning disabled child requested clarification more frequently (.94) than either normal child (.89 and .78).

Table 1 exemplifies the different types of request clarifications used by each subject (see appendix B for types and definitions). It can be seen that the majority (.63) of the learning disabled child's requests involved non-specific requets for clarification. The use of specific request types was infrequently observed (.10). It should also be noted that less specific request types, which involve the use of somewhat higher linguistic forms than

non-specific requests, occured .21 of the time.

The normal child matched on CA used a majority (.41) of non-specific requests for clarification. The use of less specific requests occurred .28 of the time and specific requests were observed less frequently (.20).

The normal child matched on linguistic level used a majority (.43) of non-specific requests for clarification. The use of specific requests occurred .34 of the time and less specific requests were infrequently observed (.01).

In sum, all three subjects used non-specific request types most frequently. Both the learning disabled child and the normal child matched on age used less specific requests more often than specific requests. In contrast, the normal child matched on linguistic level used more specific requests than less specific requests.

Table 1

Proportion and number of request responses of learning disabled child and normal children matched on chronological age and linguistic level in combined Conditions I and II.*

Type of RQ	LD Child		Normal (CA)		Normal (LL)	
	prop.	no.	prop.	no.	prop.	no.
Specific	.10	8	.20	16	.34	27
Less Specific	.21	17	.28	22	.01	1
Non-Specific	.63	50	.41	33	.43	34
NR	.06	5	.11	9	.22	18

*Conditions allowed for 80 opportunities to request clarification.

Tables 2, 3, and 4 represent the breakdown of the children's response types to the individual types of unclear messages presented by the adult. In analyzing these Tables we see no consistent patterns regarding the use of request types based on the type of unclear message. However, it should be noted that the learning disabled child did not use specific requests when the adult input was either ambiguous or unintelligible, whereas the two normal subjects did use some specific requests.

Table 2

Proportion and number of request responses of learning disabled child in combined Conditions I and II when adult input varied.

Type of RQ	Ambig		Unintel		Uninform		Part Inform	
	prop.	no.	prop.	no.	prop.	no.	prop.	no.
Specific	-	-	-	-	.10	2	.20	6
Less Specific	-	-	.40	4	.38	8	.17	5
Non-Specific	1.00	19	.50	5	.52	11	.50	15
NR	-	-	.10	1	-	-	.13	

Table 3

Proportion and number of request responses of normal child matched on CA in combined Conditions I and II when adult input varied.

Type of RQ	Ambig		Unintel		Uninform		Part Inform	
	prop.	no.	prop.	no.	prop.	no.	prop.	no.
Specific	.42	8	.30	3	.10	2	.10	3
Less Specific	.16	3	.10	1	.42	9	.30	9
Non-Specific	.42	8	.50	5	.24	5	.50	15
NR	-	-	.10	1	.24	5	.10	3

Table 4

Proportion and number of request responses of normal child matched on LL in combined Conditions I and II when adult input varied.

Type of RQ	Ambig		Unintel		Uninform		Part Inform	
	prop.	no.	prop.	no.	prop.	no.	prop.	no.
Specific	.31	6	.30	3	.38	8	.33	10
Less Specific	-	-	.10	1	-	-	-	-
Non-Specific	.58	11	.50	5	.33	7	.37	11
NR	.11	2	.10	1	.29	6	.30	9

Condition III was somewhat experimental in nature and involved a very different type of task. Here input was presented in a narrative sequence without any non-linguistic visual support. This context was designed to be somewhat similar to natural discourse. Looking at Table 5, we see that the learning disabled child used a majority of non-specific requests (.65) and specific request types were used infrequently (.05). The normal child matched on age used a majority of specific requests (.70) and non-specific requests were used less often (.30). The normal subject matched on linguistic level used specific and non-specific requests about equally.

Table 5

Proportion and number of request responses of learning disabled child and normals matched on chronological age and linguistic level in Condition III.*

Type of RQ	LD Child		Normal (CA)		Normal (LL)	
	prop.	no.	prop.	no.	prop.	no.
Specific	.05	1	.70	14	.15	3
Non-Specific	.65	13	.30	6	.20	4
NR	.30	6	-	-	.65	13

* Condition allowed for twenty opportunities to request clarification

Comparing results in Table 5, we see that the learning disabled child requested clarification more often than the normal child matched on linguistic level. However, the normal child used a greater number of specific requests than did the learning disabled child. In fact the learning disabled child used only one specific request. The normal child matched on age far exceeded the other two children in overall ability to request clarification (1.00 vs. .70 and.35) as well as in the frequency of use of specific requests (.70 vs. .05 and .15). Further breakdowns into specific request types based on particular unclear input of adult was not investigated due to the limited amount of opportunities given to request in this context.

Discussion

As was previously stated, we found that the learning disabled child requested clarification more frequently than both normal children matched on chronological age and linguistic level in Conditions I and II. Our results are similar to the findings of Gale et.al. (1981) who reported that the function of request clarification is evident with equal frequency in both normal and language impaired children. However, it should be noted that Gale and her colleagues looked at non-verbal as well as verbal request forms, whereas we only analyzed verbal requests. Therefore, without including non-verbal acts, we observed a high frequency of use of request clarifications.

In contrast to our findings, Donahue et.al. (1980) and Brinton and Fujiki (1982) found that learning disabled children did not request clarification as frequently as normal children. As indicated, these conflicting results may be due to differences in the contexts used in each study. However, one of our contexts (Condition I) was similar to Donahue's and our results conflict. However, it is unclear as to how Donahue and her colleagues matched their control subjects. They stated that they matched on school, grade, and sex. Thus, one would assume that the children were matched on age and not necessarily on linguistic level. The best way to match older learning disabled children is controversial. Each study previously discussed used somewhat different criteria.

The next question of interest involved whether or not the children used specific, less specific, and/or non-specific request types (in Conditions I and II). Here we were particularly interested in the child's ability to use more explicit or advanced linguistic forms. These request types (i.e., specific and less specific) require a broader range of syntactic and semantic abilities. For example, "Which color spots?", is more explicit than "what?".

Our results indicated that the learning disabled child infrequently used specific and less specific request forms. The majority of his requests fell within the non-specific area. When we combined the child's use of specific and less specific request types, the learning disabled child used approximately the same proportion as the normal child matched on linguistic level. In contrast, the normal age-matched subject used a greater proportion of specific and less specific request types. To reiterate, although the learning disabled subject did request clarification frequently, he used linguistically less sophisticated forms for his age, similar to the type of forms used by younger normal children. These results are similar to those of Gale et.al. (1981) who reported that their learning disabled subjects used fewer "precise" linguistic forms than normal children.

In contrast, our results are different than those of Donahue et.al. (1981). They found that learning disabled and normal children matched on age requested clarification using the same amount of specific request forms.

As stated previously, our findings in Condition III were different from the data in Conditions I and II. Condition III was somewhat experimental in nature and did not involve non-linguistic visual support. Utterances were presented in narrative form. In addition, a minimal amount of data was collected in this Condition. Thus, our comments regarding the results here can only be looked at as tentative. In Condition III, the normal age-matched subject requested clarification most frequently and used the greatest proportion of specific request types. However, in this particular context we inadvertently used stories which exceeded the grade level of normal subjects matched on linguistic level. Similar to the other Conditions, the learning disabled child initiated requests which were non-specific in nature. It is possible that the linguistic skills needed for this task may have been too great for the learning disabled child, and thus he used less sophisticated forms to request clarification.

In sum, several hypotheses have been raised as to why learning disabled children may not request clarification as often as normal children. These hypotheses infer social, cognitive, and/or linguistic deficits in this subgroup of language impaired children (Donahue et.al., 1980). The results of our study (Conditions I and II), do not lend support to the idea that learning disabled children possess a social deficit insofar as it relates to the communication abilities in this study. Social deficits may be appparent in other aspects of these children's communicative skills. If the ability to request clarification of unclear messages can be viewed as one social skill, then our learning disabled child was able to assert himself when necessary. However, it should be noted that his ability to request clarification may be a positive by-product of language therapy where he was encouraged to become an increasingly more active participant in discourse. Although these specific pragmatic skills were

not trained, his therapy progam encouraged active participation in conversational interactions.

Cognitive deficit hypotheses have also been suggested as a reason for learning disabled children's conversational deficits (Donahue et.al., 1980). Our results indicated that the learning disabled child possessed the ability to use request clarifications as a problem-solving strategy.

Finally, a linguistic deficits hypothesis has been posited as the basis for the children's communication deficits. Our findings do suggest that learning disabled children may be deficient in the use of specific linguistic forms to request clarification. The question which emerges from our data is whether or not our learning disabled child has not yet acquired these necessary specific language forms or has not learned to spontaneously use these forms in certain contexts. Learning disabled children may not be able to draw from their lexical storehouse spontaneously and on demand. Our learning disabled subject did use many of the specific linguistic forms needed to request clarification in other contexts.

Certainly, the need for continued investigation of the nature of learning disabled children's deficits in cognitive, social, and linguistic areas is evident. It seems that their communication problems may be the result of an interaction involving cognitive, social, and linguistic deficits. At this point, there is not enough evidence to tease apart these complicated etiological factors. What is clear is that regardless of the specific underlying domain(s) of difficulty, we need to pay attention to each of these areas in the assessment and modification of learning disabled children's communicative skills.

References

Brinton, B. and Fujiki, M. A comparison of request-response sequences in the discourse of normal and language disordered children. Journal of Speech and Hearing Disorders , February 1982, 47, 397-403.

Bryan, T., Donahue, M., and Pearl, R. Learning disabled children's communicative competence and social relationships. Language, Learning, and Reading Disabilities: A New Decade . Preliminary Proceedings of an Interdisciplinary Conference, Department of Communication Arts and Sciences, Queens College of the City University of New York, May 1981a, 67-77.

Bryan, T., Donahue, M., and Pearl, R. Studies of learning disabled childen's pragmatic competence. Topics in Language & Learning Disabilities , July 1981b, 29-39.

Bryan, T., Donahue, M., Pearl, R., and Sturm, C. Learning disabled children's conversational skill- The "TV talk show." Learning Disability Quarterly , Summer 1981, 4, 250-259.

Culatta, B., Page, J., and Ellis, J. Story retelling as a communicative performance screening tool. Language, Speech and Hearing Services In Schools , April 1983, 14, 66-74.

Donahue, M., Pearl, R., and Bryan, T. Learning disabled children's conversational competence: responses to inadequate messages. Applied Psycholinguistics , 1980, 1, 387-403.

Gale, D.C., Liebergott, J.W., and Griffin, S. Getting it: Children's requests for clarification. ASHA Convention, Los Angeles, 1981.

Garvey, C. Requests and responses in children's speech. Journal of Child Language , 1975, 2, 41-63.

Ironsmith, M. and Whitehurst, G.J. The development of listener abilities in communication: How children deal with ambiguous information. Child Development , 1978, 49, 348-352.

Morehead, D.M. and Ingram, D. The development of base syntax in normal and linguistically deviant children. Journal of Speech and Hearing Research , 1973, 16, 330-352.

Rees, N. An overview of pragmatics, or what is in the box? In J.V. Irwin (ed.), Pragmatics: The Role in Language Development . California: Fox Point Publishing Co., 1982.

Shatz, M. and Gelman, R. The development of communication skills: modification in the speech of young children as a function of listener. Monographs of the Society for Research in Child Development , 1973, 38, 1-37.

Snyder, L. Pragmatics in language disorder children: their prelinguistic and early verbal performatives and presuppositions. Unpublished doctoral dissertation, University of Colorado, 1975.

Wollner, S.G. and Geller, E. Methods of assessing pragmatic abilities. In J.V. Irwin (ed.), Pragmatics: The Role in Language Development . California: Fox Point Publishing Co., 1982.

Appendix A

Definitions of Adult Input for Conditions I and II

1- Unintelligible -A specific part of the adults utterance contained jargon (ie: Show me the bird with the _____; Put the _____ on top of the window).

2- Ambiguous -The adults utterance contained no specific attribute nor referent (ie: Show me that one; Put that there).

3- Partially Informative -The adults utterance lacked one specific attribute and named the referent (ie: Show me the white horse- there were two white horses with second attributes; Put the red lego in front of you- there were two sizes to choose from).

4- Uninformative -The adult utterance contained a referent but no attribute (ie: Show me the dog- there were three dogs with different attributes; Put the wheels on the bottom of the piece in front of you- there were two different sets of wheels).

Definitions of Adult Input for Condition III

1- Neologism -A nonsense word was placed in a grammatical message (ie: Janet and Susan started to rechach).

2- Omission -The adult utterance involved a deletion of one important part of the message, usually a single noun or verb (ie: He gave all the children at McDonald's a great big red _____).

3- Unintelligible -See above.

Appendix B

Definitions of Request Types Used by Child

1- Specific Request -The child mentions a specific feature or critical attribute of the referent or indicated the source of the misunderstanding (ie: What's rechach mean?; Which color spots?; What size blue lego?).

2- Less Specific -The child mentions the referent but not the specific feature or critical attribute that is the source of the misunderstanding (ie: Which dog?; What red lego?).

3- Non-Specific -The child uses an unspecific request for more information without mentioning the referent or its attributes, or merely indicated that he or she did not understand (ie: Which one?; Huh?; I don't understand?).

Description of each set of pictures used in Condition I

1-Turtle with green spots, turtle with brown spots, turtle without spots.

2-Big cannon with green stars, little cannon with green stars, little cannon with blue stars.

3-Pink hat with pompom, pink at without pompom, yellow hat with pompom.

4-Big ball with blue circles, big ball with pink circles, little ball with pink circles.

5-Lady bug, lady bug with no spots or legs, lady bug with no spots.

6-Duck with green buttons, duck with pink button, duck with no buttons.

7-Little snowman wearing black hat, little snowman wearing red hat, big snowman wearing black hat.

8-Chocolate ice cream cone, chocolate ice cream cone with a cherry on top, strawberry ice cream cone.

9-Bitten pear, bitten pear with brown worm, bitten pear with orange worm.

10-Little brown bear, big brown bear, big black bear.

11-Red balloon with string, blue balloon with string, blue balloon without string.

12-Square watch with numbers, round watch with numbers, round watch without numbers.

13-Bird with red ribbon, bird with blue ribbon, bird without ribbon.

14-Two boys holding purple oval, two boys holding green oval, one boy holding purple oval.

15-Chocolate cupcake, vanilla cupcake, vanilla cupcake with candle.

16-Brown shirt, brown shirt with buttons, purple shirt with buttons.

17-Birthday cake with lit candle, birthday cake with lit candle and cherries, birthday cake with unlit candle.

18-Big brown horse, big white horse, little brown horse.

19-Train with wheels and smoke, train with wheels and no smoke, train with no wheels but had smoke.

20-Dog with orange spots, dog with yellow spots, dog without spots.

21-Doll wearing orange dress and no shoes, doll wearing green dress and no shoes, doll wearing green dress and shoes.

22-Big brown and yellow jar, big brown and orange jar, little brown and yellow jar.

23-Yoyo with green star and long string, yoyo with red star and long string, yoyo with red star and short string.

24-Chair, chair with short legs, chair with short legs and rug under it.

25-Monster wearing black cape holding yellow circle, monster wearing black cape holding orange circle, monster wearing red cape holding yellow circle.

Appendix D

Twenty-five examples of adult input for Condition II

1-Show me the turtle without the spots.

2-Show me the cannon with the green stars.

3-Show me that one.

4-Show me the ball with the pink circles.

5-Show me the bug unintelligible .

6-Show me the duck with the green buttons.

7-Show me the snowman.

8-Show me the chocolate ice cream cone.

9-Show me the pear with the orange worm.

10-Show me the brown bear.

11-Show me this.

12-Show me the watch with the numbers.

13-Show me it.

14-Show me the one with the oval.

15-Show me the cupcake with the vanilla frosting.

16-Show me the shirt with the buttons.

17-Show me the cake with the cherries on it.

18-Show me the big horse.

19-Show me the train.

20-Show me the dog with the spots.

21-Show me the doll with the green dress.

22-Show me the little jar.

23-Show me the yoyo.

24-Show me the chair.

25-Show me the monster unintelligible .

Appendix E

Fifteen examples of adult input from Condition II (Each step depended on the prior step. Therefore, the visual context aids in following the preceding steps.).

1-Take the red lego with the colored dots on it and put it in front of you.

2-Put the small wheels on the lego in front of you.

3-Take the other set of small wheels and put them on the other end (show child).

4-Put the big lego on the yellow dots.

5-Put the door on the green dots.

6-Put a big white lego on top of the unintelligible .

8-Put the lego on top of the big clear lego.

9-Put the big red lego on.

10-Put a big yellow lego on top of the door.

11-Put the little lego here (show child).

12-Put the lego on top of the little blue lego.

13-Put a little blue lego unintelligible .

14-Take the wheels that you have left and put them in front of you.

15-Take the two long legos and put them in front of you.

Appendix F

Sample story read from Condition III

This story is about two little omit . Their names are Susan and omit . One day they were playing at Susan's house when Susan's mother said, "Let's go to unintelligible for lunch." After the girls washed their hands they went out and got in the omit . Then guess what? The car wouldn't omit . Janet and Susan started to rechach ; they could not get on the omit . So they walked to the corner and waited for the bus. When they got to McDonald's, Janet and Susan had cheeseburgers and asswak . While they were eating, guess what happened? A man dressed up like a omit came in. He gave all the children at McDonald's great big red omit .

CONTENTS OF THE FIRST ELEVEN VOLUMES

Volume I - 1972

A program for teaching the pronomial pair his and her to an autistic-like child
Edna Veth

The generalization of antonyms in a language impaired child
Adriana B. Oleksiuk and Cheryl Barry

A comparison of the effects of visual versus auditory heightening of a stimulus in training a language impaired child
Elaine Geller

Juncture as a facilitator in verbal imitation
Jane Rothblatt Carp

Effects of varying temporal intervals in stimulus presentation
Leonard Israel

The use of multi-modal stimuli in teaching an aphasic child
Cheryl Barry and Sue Salomon

Response cost in speech training
Leonard Israel and Sherry Gilman

Food deprivation as a factor in teaching discriminated responding to a language impaired child
Dorothy Rosen

The language impaired child: a case study
Ilene Brooks

Volume II - 1973

Two procedures for eliminating disruptive behavior in a seven year old boy
Paula Krenkel and Froma Roth

Positive reinforcement of fluency in a young stutterer
Frances Hartstein Barabell and Beatrice Stocker

Using the bounce technique with an adult stutterer
Adriana Oleksiuk and Arlene Wisan

Stimulus factors in the training of prepositional usage in two language impaired children
Adriana B. Oleksiuk

A distinctive feature approach to articulation therapy with a seven year old girl
Lauri Greenberg and Froma Roth

The effect of mode of stimulus presentation of the performance of a hearing impaired child in an imitative task
Harriet Gross, Lorain Wankoff and Lynn Amsel

The use of color cues in the training of sequencing behavior with a hearing impaired child
Karen Travis and Renee Toueg

Social interaction between two language impaired children
David Baskin, Brenda Klein and Dorothea Schwartz

Volume III- 1974

A comparison of two types of articulation therapy with a pair of twins
Joan Kamerman, Barbra Stein, Arlene Wisan and Cynthia Shewan

Highlighting-semantic categories of interrogative words in question formation by a hearing-impaired child
Karen Travis, Lorain L. Wankoff and Robert L. Rosenbaum

Decreasing response latency through operant procedures
Linda Reider

The effects of self highlighting fluent words on the speech of an adolescent stutterer
Phillip Schneider

The use of a sentence construction board in the training of sentential word order in an aphasic children
Karen G. Kronheim and Froma Roth

A comparison of two reinforcement techniques in increasing fluency in an adolescent
Judith Rosenblum and Sharon Klicka Pearl

Reinforcement as a means of increasing innovative speech behavior
Jean Deitsch and Donna Thal

A hearing and language impaired child: a study of the first three months of training
Maura Greenberg

Volume IV - 1975

A program for increasing self-initiation of verbal behavior
Susan Jager, Ellen Kriegel and Elaine Geller

The effects of fading on the acquisition and retention of sight reading in a language delayed child
Rebecca Levi and Ellenmorris Tiegerman

Teaching cojoined sentences to a language impaired child
Patrice Tomasetti, Nancy Schwartz and Arlene Wisan

The use of shadowing in reducing the number of starters in the speech of a young male stutterer
Geraldine Gibbia and Robert Goldfarb

The elimination of drooling through overcorrection
Hope Guglielmo and Robert Goldfarb

Clinical application of semantic feature theory
Ann D. Jablon and Froma Roth

The effects of training conceptual categories on appropriate responding to three wh question forms
Ellen H. Spund, Rita R. Unterberger Cohen and Elaine Geller

A distinctive feature approach to articulation therapy with a hard of hearing child
Ellen Kriegel and Lynn Amsel

An application to the premack principle as a reinforcer for play behavior
Ilene Bayone and Elaine Geller

Volume V - 1976

The efficacy of discrimination training in articulaton therapy with a verbal dyspraxic child
Mira Senders and Elaine Geller

The effect of the response criterion on the maintenance of perseverative behavior in a successive and stimultaneous discrimination
Milly Finkelthal, Ellenmorris Tiegerman and Nancy Shamow

A procedure for training matching-to-sample and task completion:Its theoretical relationship to testing and evaluation
Yvette Josephson, Ellenmorris Tiegerman and Nancy Shamow

The use of verbal instructions and a fading procedure for training temporal relatioships to a language impaired child
Maureen Fitzgerald Foley, Dorothea Schwartz and Nancy Shamow

Language learning effects on speech discrimination
Judy Sklar, Marvin Mazor and Lawrence Deutsch

A backward chaining procedure for teaching two-syllable words to a language impaired child
Robin E. Fishman, Donna Thal and Nancy Shamow

A progrm for teaching agent-action-object sequences to a language impaired child
Sheryll Birnbaum and Donna Thal

The use of timeout to eliminate the disruptive behavior of a speech and language impaired child
Frances Kasten and Dorothea Schwartz

A therapeutic program for training the expressive language of an adult aphasic

The use of shadowing in reducing the number of starters in the speech of a young male stutterer
Geraldine Gibbia and Robert Goldfarb

The elimination of drooling through overcorrection
Hope Guglielmo and Robert Goldfarb

Clinical application of semantic feature theory
Ann D. Jablon and Froma Roth

The effects of training conceptual categories on appropriate responding to three wh question forms
Ellen H. Spund, Rita R. Unterberger Cohen and Elaine Geller

A distinctive feature approach to articulation therapy with a hard of hearing child
Ellen Kriegel and Lynn Amsel

An application to the premack principle as a reinforcer for play behavior
Ilene Bayone and Elaine Geller

Volume V - 1976

The efficacy of discrimination training in articulaton therapy with a verbal dyspraxic child
Mira Senders and Elaine Geller

The effect of the response criterion on the maintenance of perseverative behavior in a successive and stimultaneous discrimination
Milly Finkelthal, Ellenmorris Tiegerman and Nancy Shamow

A procedure for training matching-to-sample and task completion:Its theoretical relationship to testing and evaluation
Yvette Josephson, Ellenmorris Tiegerman and Nancy Shamow

The use of verbal instructions and a fading procedure for training temporal relatioships to a language impaired child
Maureen Fitzgerald Foley, Dorothea Schwartz and Nancy Shamow

Language learning effects on speech discrimination
Judy Sklar, Marvin Mazor and Lawrence Deutsch

A backward chaining procedure for teaching two-syllable words to a language impaired child
Robin E. Fishman, Donna Thal and Nancy Shamow

A progrm for teaching agent-action-object sequences to a language impaired child
Sheryll Birnbaum and Donna Thal

The use of timeout to eliminate the disruptive behavior of a speech and language impaired child
Frances Kasten and Dorothea Schwartz

A therapeutic program for training the expressive language of an adult aphasic using melodic intonation therapy
Ellen Bader and Robert Goldfarb

Volume VI - 1977

The efficacy of imitation and comprehension training on the linguistic performance of a language impaired child
Janet Shugar Hoffman and Sima Gerber Wollner

The use of backward vs forward chaining procedures in the training of CVC words with a language impaired child
Robin Vermont and Ellenmorris Tiegerman

Acoustic reflex behavior as a function of temporal patterning of 4000 cps tones
Marsha Wiener-Kasdan and Marvin Mazor

The use of a progressive DRO procedure to eliminate jrgon in a language impaired child
Ellen Korenstein and Donna Thal

The effect of pictoral stimuli and object manipulation on the intratherapy generalization of action-object sequences with a language impaired child
Stephanie Gams and Ellenmorris Tiegerman

Temporal integration in dysphasic children
Renee Hochman, Donna Thal and Antonia Maxon

Volume VII - 1978

The use of imitation in training form and content with an echolalic child
Sandra Baldo, Sima Gerber Wollner and Elaine Geller

Tye question is input....but what's the answer?
Jill Berger Seid, Elaine Geller and Sima Gerber Wollner

The pagmatic development of an emotionally disturbed child. Are there any comments?
Bonnie Schecterman, Sina Gerber Wollner and Elaine Geller

Delayed pure tone auditory feedback as a method of hearing testing for young children
Ann B. Newman and Marvin Mazor

The effect of time altered stimulus presentation on an adult aphasic's clustering ability
Elizabeth Scharf and Robert Goldfarb

The efficacy of passive observation training in a language impaired child
Bonnie Baval and Ellenmorris Tiegerman

Mirror-image interaction: The development of observational skills in autistic children
Rita Carol Silverman and Ellenmorris Tiegerman

Volume VIII - 1979

The acquisition of arbitrary and iconic signs: imitation vs. comprehension
Kathleen R. Polzer, Lorain L.Wankoff and Sima Gerber Wollner

Phonemic and non-phonemic error patterns in non-verbal apraxia and verbal apraxia
Susan T. Dworetsky and Lynne W. Clark

Auditory identification and sequencing of linguistic and non-linguistic stimuli by three language impaired children
Patricia Barone and Donna Thal

Two language disordered children and their comprehension of indirect directives
Cheryl Royster-Branker and Deena Bernstein

The use of the differential loudness summation test with children with sensory-neural hearing losses
Ilyse Paderewski and Marvin Mazor

Developing conversational skills in a language impaired child through television modeling
Helen Lasky and Robert L.Rosenbaum

Comparing imitation and comprehension training in two language impaired children
Susan Paluszek and Fran Kasten Feintuch

Volume IX - 1980

A method of pragmatic analysis for a Down's Syndrome Child
Paula Halfond and Pauline Lipson Tamari

Follow the leader: Why a language disordered child can't be 'it'
Cathleen Grossfeld and Elaine Geller

Communication patterns of an autistic child
Robin L. Rosoff and Ellenmorris Tiegerman

Children's perception of sequenced pitch patterns
Dorothyann Hughes and Marvin Mazor

The role of verb aspect in training a grammmatical morpheme
Pamela Birenbaum and Fran Kasten Feintuch

Nature of spelling errors in trranscortical sensory aphasia: A case study
Michael L. Grossfeld and Lynne W. Clark

Volume X - 1981

Assessing pragmatic functioning in language disordered children
Kathleen Majlinger, Paula Modugno, Sima Gerber Wollner and Susan Longtin

The rules of comprehension and the semantics of verbs in training an adult to produce a grammatical morpheme
Adrienne Ollendorf and Susan Longtin

Early emergence of a verbal inflection: semantic and pragmatic considerations
Ginette A. Rand, Renee Hochman Kornet, and Fran K.Feintuch

The effect of age on the prediction of hearing levels from acoustic reflex thresholds in persons with high frequency hearing losses
Tamar Feder, Marvin Mazor and Randi Sherman

A case study of a Down's syndrome child's discourse abilities
Susan Faine and Susan Longtin

Focusing on mother-child interaction in therapy with a language impaired child
Eileen Kriehn and Elaine Geller

A pragmatic touch to teaching an emotionally disturbed child prosody
Constance Siomkos and Sima Gerber Wollner

Volume XI - 1982

The input of a mother, teacher, and clinician to a language impaired child.
Naomi Teitelbaum and Sima Gerber Wollner

I'm an Aunt; You're an Ant: an investigation of the ability to train lexical ambiguity awareness in a Down's syndrome child
Wendy Beaton, Ann D. Jablon, and Nancy Z. Schwartz

Effects of age and sex on the self assessment of hearing handicap
Deborah R. Cancro, Sandra J. Nicosia, and Marvin Mazor

A descriptive study of immediate echolalia: semantic/syntactic and functional aspects
Theresa Edgar-Bartollotta and Diane Happas

Speech act production of adult aphasics
Christine Rampello, Lillian Wright, and Sima Gerber Wollner